MAY 24 1937

AUTOMOTIVE INDUSTRIES

LAND · — AIR — WATER

MAY 22, 1937

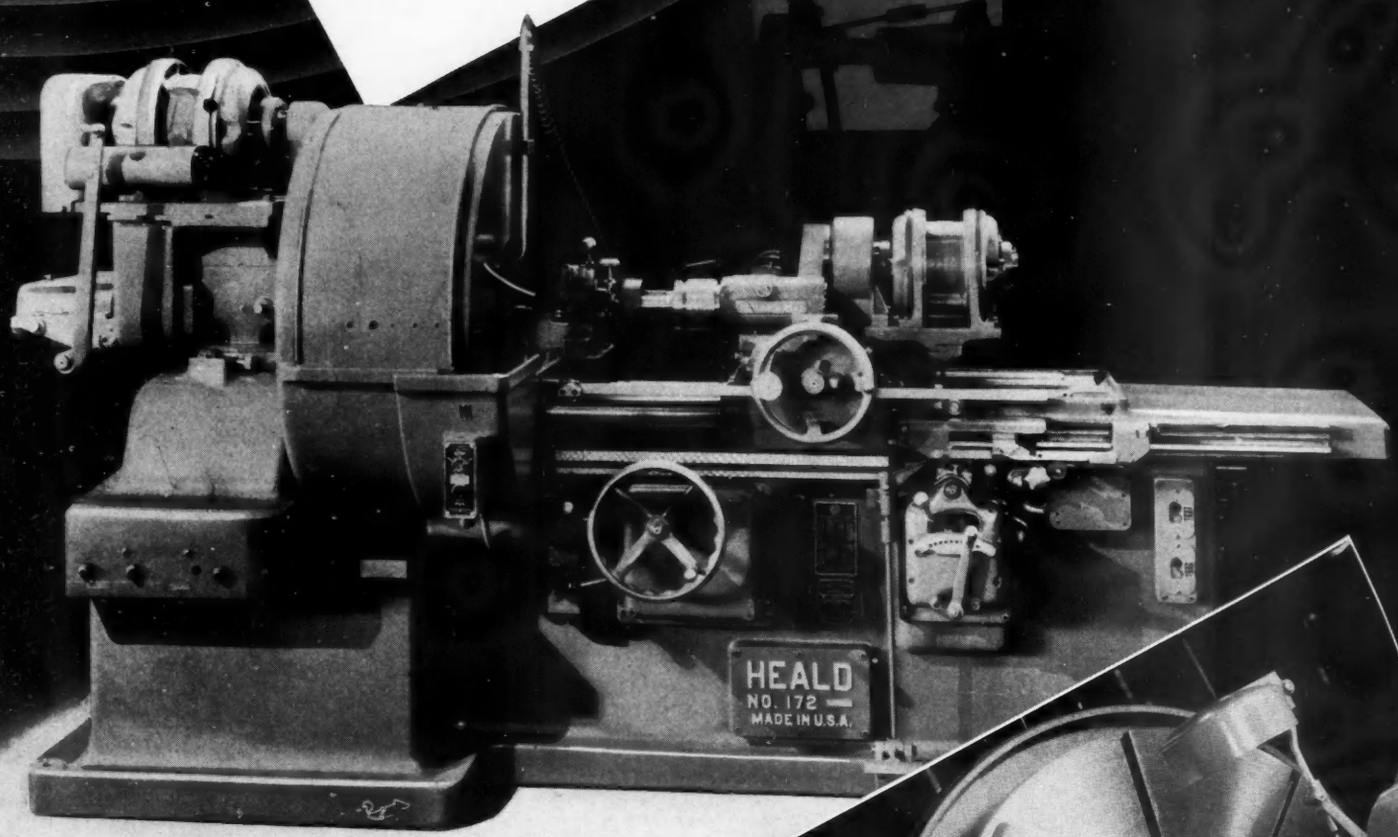
SEALED!
These two new departures by New Departure will add longer carefree life to 1937 cars:
Fan and Water Pump Bearing, completely sealed and lubricated for life, now used for the first time by Cadillac, Graham, LaSalle, Olds, Pontiac and Yellow Coach.
Rear Wheel and Propellor Shaft Bearing, completely sealed and lubricated for life. Used by Graham, LaSalle, Cadillac, Olds, Packard and Pontiac.
Write for further details to New Departure, Division General Motors Corporation, Bristol, Connecticut.

NEW DEPARTURE

PIONEER OF SELF-SEALED BEARINGS . . .

N-D-Seals

FOR Large SWING WORK



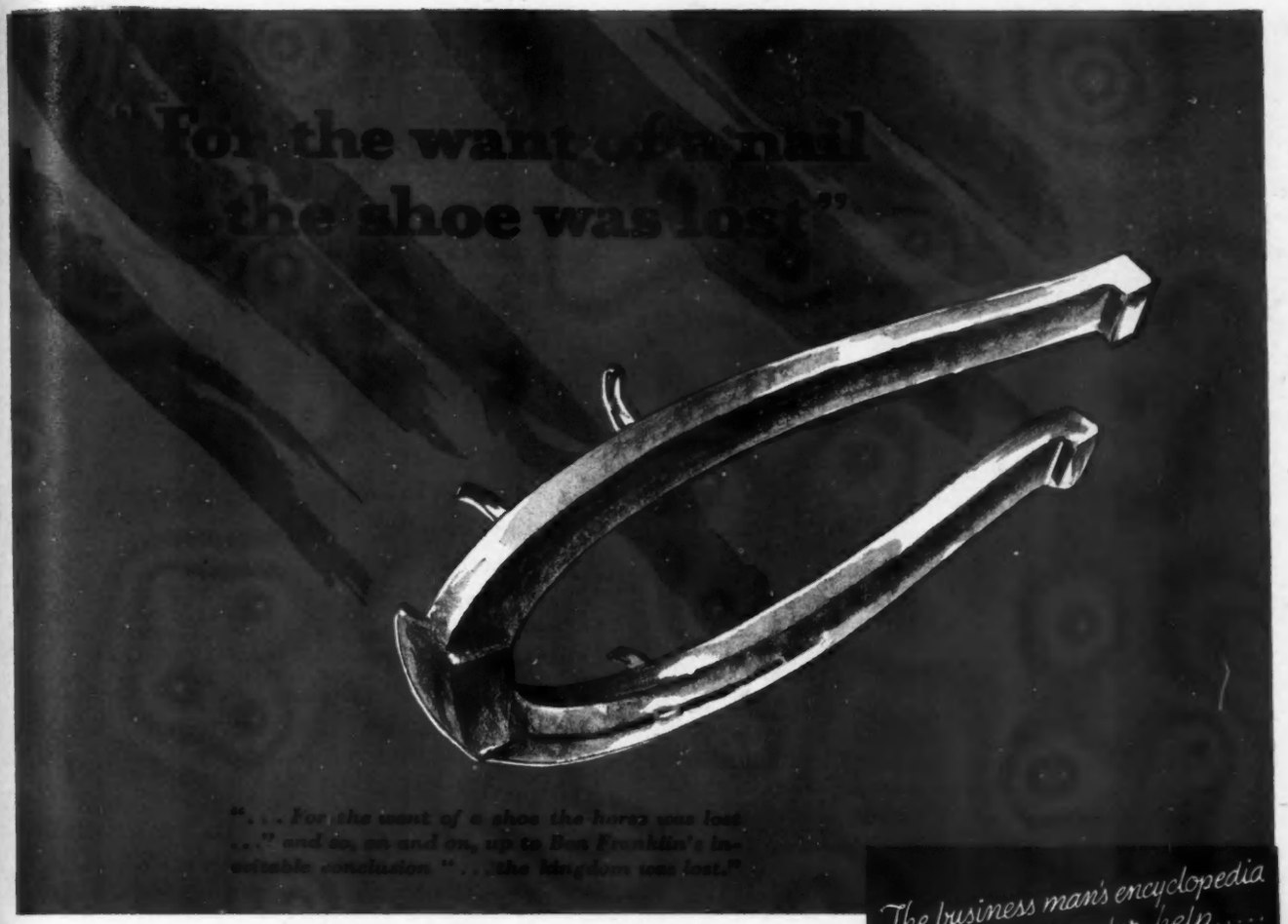
THE No. 172 Gap Internal is especially designed and built for handling large gears, plates, connecting rods and similar parts that require a large swing.

This machine will permit a swing of 36" and can be adjusted to provide a gap of from 6" to 14". Thus the width of gap can be made to suit exactly the length of work to be ground and makes possible the use of a minimum length of wheel spindle giving maximum rigidity at all times.

The controls and driving units are similar to the well-known No. 72 line of Internals. To take care of the type of work likely to be ground on this machine, it has a very low work center with a work guard that swings entirely back permitting overhead loading by a crane.

A new bulletin has just been printed. May we send you one?

THE HEALD MACHINE CO., WORCESTER, MASS., U. S. A.


"For the want of a nail
the shoe was lost"
". . . For the want of a shoe the horse was lost
. . ." and so, on and on, up to Ben Franklin's inevitable conclusion ". . . the kingdom was lost."

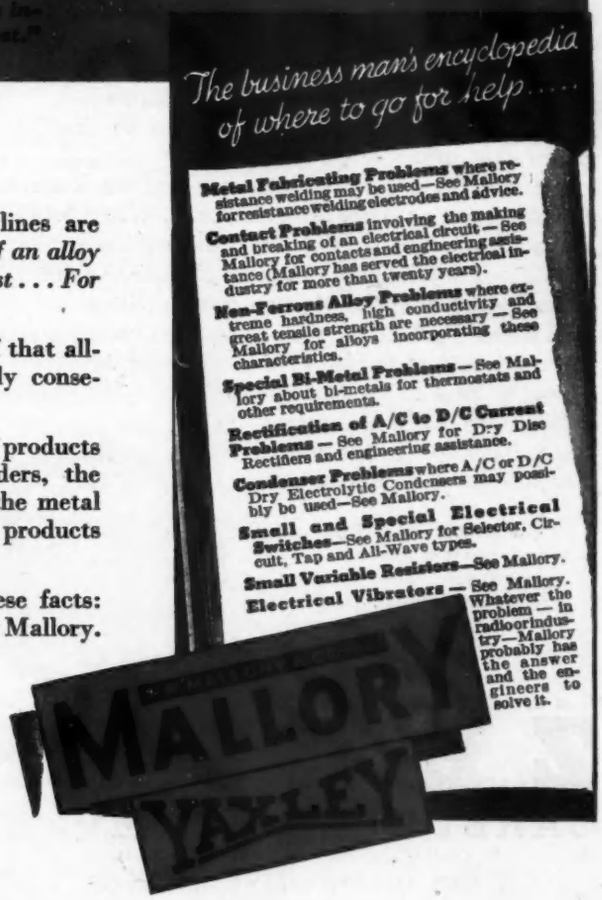
MODERNIZED versions of Poor Richard's famous lines are enacted day after day in American plants . . . *For want of an alloy the product was lost . . . For want of a tip the welding was lost . . . For want of a rectifier the market was lost.*

The business of P. R. Mallory & Co. is the supplying of that all-important "nail" to industry before the train of costly consequences gets under way.

The industries served by Mallory engineering and Mallory products include the motor car manufacturers, the radio builders, the refrigerator makers, the railway and airway suppliers, the metal furniture fabricators, the companies producing electrical products and appliances.

A sample of the service rendered is best given by these facts: Electrical contact points in most automobiles are made by Mallory. Three out of every four auto radios are equipped with Mallory-made Vibrators. The electrodes for resistance welding in modern metal fabrication are supplied by Mallory. Switches, condensers and volume controls used in all-wave radio sets, and in other industries, are Mallory products.

Call upon us when your problems fall within our scope. To help visualize that scope in terms of your problems, we note nine situations where we can answer your help wanted inquiry.


The business man's encyclopedia of where to go for help . . . .
Metal Fabricating Problems where resistance welding may be used—See Mallory for resistance welding electrodes and advice.
Contact Problems involving the making and breaking of an electrical circuit — See Mallory for contacts and engineering assistance (Mallory has served the electrical industry for more than twenty years).
Non-Ferrous Alloy Problems where extreme hardness, high conductivity and great tensile strength are necessary — See Mallory for alloys incorporating these characteristics.
Special Bi-Metal Problems — See Mallory about bi-metals for thermostats and other requirements.
Rectification of A/C to D/C Current Problems — See Mallory for Dry Disc Rectifiers and engineering assistance.
Condenser Problems where A/C or D/C Dry Electrolytic Condensers may possibly be used—See Mallory.
Small and Special Electrical Switches—See Mallory for Selector, Circuit, Tap and All-Wave types.
Small Variable Resistors—See Mallory.
Electrical Vibrators — See Mallory. Whatever the problem — in radio or industry — Mallory probably has the answer and the engineers to solve it.
MALLORY
YAXLEY

P. R. MALLORY & CO., INC., INDIANAPOLIS, INDIANA

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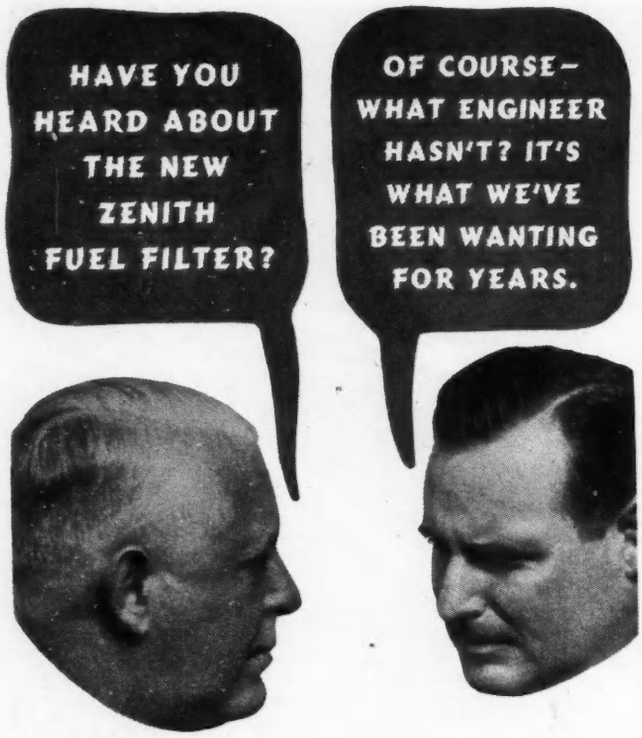


WHENEVER automobile engineers gather, that's where you'll hear the facts about the sensational new Zenith Fuel Filter. For it's what they've needed, wanted, hoped for . . . for years and years.

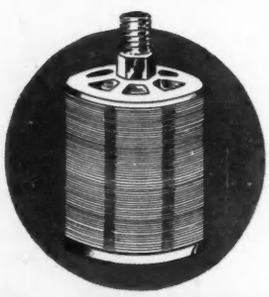
Zenith Fuel Filters feature revolutionary new-type filter elements which absolutely banish dirt, dust, rust and moisture. They *assure* more mileage . . . and stepped-up performance . . . because they *insure* clean gasoline.

No wonder more and more car and truck manufacturers—such as Buick, International, White and GMC are adopting Zenith Fuel Filters as original equipment.

The Zenith Fuel Filter ends for all time the difficulties encountered with the old-type screen filter.

A Zenith Fuel Filter can be installed in any standard mechanical fuel pump with glass sediment trap. It is inexpensive and can be cleaned in a few moments.

For more detailed information and prices—ask us to have a representative call on you.



The assembly of brass discs and spacers through which gasoline is filtered in a Zenith Fuel Filter. Openings are .002 of an inch, several times as fine as ordinary 100 mesh wire gauze.

ZENITH

CARBURETOR COMPANY

(Subsidiary of Bendix Aviation Corporation)

699 Hart Avenue, Detroit, Michigan

"Built for Permanence — Calibrated for Performance"

AUTOMOTIVE INDUSTRIES
with AUTOMOBILE

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Published Weekly

Volume 76 — Number 21

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OFFICES

Philadelphia—Chestnut & 56th Sts., Phone Sherwood 1424
New York—239 W. 39th St., Phone Pennsylvania 6-1100. Chicago—Room 916, London Guarantee & Accident Bldg., Phone Franklin 9494. Detroit—1015 Stephenson Bldg., Phone Madison 2090. Cleveland—609 Guardian Bldg., Phone Main 6860. Washington—1061 National Press Bldg., Phone District 6877. San Francisco—444 Market St., Room 305, Phone Garfield 6788. Long Beach, Cal.—1595 Pacific Ave., Phone Long Beach 613-238.
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AUTOMOTIVE INDUSTRIES

May 22, 1937
Vol. 76, No. 21

Reaching For 1929

Limited dealer stocks are acting as a very definite check on motor vehicle retail sales which at this time would be soaring to the 1929 level if enough cars were available for delivery. Even with the inadequate inventories with which most dealers are now struggling, the industry's sales in the domestic market this month are expected to cross the 500,000 unit mark. One authority estimates that upwards of 425,000 passenger cars and a minimum of 75,000 trucks will be delivered in the United States during May.

Small Dealer Stocks Curb Sales

Production Forced Up to Provide Field Stocks for Season's Best Month; Good Summer Anticipated

May Estimates

Sales: 500,000 cars and trucks
Production: 560,000 cars and trucks

The current month undoubtedly will mark the peak in retail sales for the year just as it will in production. Dealers are still very short of field stocks. The projected May deliveries of 500,000 cars and trucks compare with an estimated 465,000 units delivered in April and 480,000 in March. Retail deliveries in May last year approximated 456,000 cars and trucks. On the whole, the automobile business should continue to show a fair margin of gain over corresponding months of last year. As an indication of expectations for summer volume, one of the leading companies has set up sales quotas for July and August approximately on a par with its spring business.

However, the few companies which have been free to build up their field stocks are beginning to show a slight easing in sales in line with the usual seasonal trend. For them, the peak probably has been reached, although the overall car shortage in the industry will serve to maintain their volume not far under the spring peak for some time. The major portion of the industry will be working against a car shortage all through the second quarter with sales volume governed solely by the rate of production.

The industry's output is holding very close to the peak rate of between 27,000 and 28,000 cars and trucks per day. Sporadic strikes of short duration have hindered operations of a number of plants already this month but union leaders are making a determined effort to hold their members in line to prevent unauthorized strikes in violation of agreements. Despite these interruptions and a slight easing of the Ford production rate, the May estimate for the industry still stands at around 560,000.

Packard Motor Car Co.'s April shipments set a new record at 15,164 cars. The total compared with 14,550 in March and with 7826 in April of last year. Dealer stocks were cut slightly during the month since deliveries totaled 14,665, also a new high mark, against 12,602 in March and against 7042 in April, 1936. General Manager Gilman said preliminary May reports indicated that May deliveries will run about twice those for the same month of last year.

(*Turn to page* 760, *please*)

Large Fleets' Gross Best

Census Bureau's 1935 Data Shows For-Hire Truckers' Results

Large for-hire truck fleets show the best per-truck gross revenues with the average for fleets of between 50 and 99 trucks clearly in excess of the average for any other size fleet, according to Bureau of the Census reports for the year 1935, just released in full.

For-hire truckers in general use larger vehicles than do other users of commercial vehicles. Of the total number of trucks in such use as shown by the census, 48.2 per cent had a capacity of over 1½ tons. Only 5.7 per cent of the for-hire trucks in use were of the ¾ ton type. Even more marked was the trend toward use of larger vehicles in interstate operations. In this group of carriers 62 per cent of the trucks were over 1½ tons.

Motor trucks, as distinguished from tractors, semi-trailers and trailers, were the largest single class of vehicle in use for hire. Of the 179,824 vehicles for which detailed inventory information was given to the census department's checkers, 126,710 or 70.5 per cent were motor trucks, 21,440 or 11.9 per cent were tractors, 23,594 or 13.1 per cent were semi-trailers and 8,080 or 4.5 per cent were trailers. The report said that both interstate carriers and operators of large fleets make greater use of tractors, semi-trailers and trailers.

(*Turn to page* 761, *please*)

This Week

NEWS from the field tells of concerted efforts to supply dealers with enough cars to meet the demand in May, peak selling month . . . It is said that sales in some centers are being hampered by lack of cars for selection . . . Oldsmobile announces optional installation on the Eight of new automatic transmission . . . Details have become available on the new Allison 1000 hp. V-12 aircraft engine, first designed to use ethylene glycol for cooling and first liquid cooled engine of that size to receive Army approval.

FEATURE is a detailed report of the technical features of the centrifugal clutch of the monodrive automatic transmission used on buses in Chicago and New York . . . Abstracts of more of the papers read at the S.A.E. Summer Meeting are presented . . . Contents of unique Mercedes Museum are described.

Olds Offers Special Transmission

Automatic, Four Speed Pre-selective Control Made Available as Factory Option on Eight for $80.

A new automatic transmission with four pre-selected forward speeds is being shown publicly for the first time by Oldsmobile dealers in Detroit. As quickly as production can be enlarged, showings will be held in Chicago, New York and several other large cities.

The new transmission, said C. L. McCuen, general manager of Oldsmobile, will for the time being be available only as a factory installation on new Oldsmobile eights at an additional cost of $80. It cannot be substituted on eights already in service. Both six and eight will continue to be manufactured with the standard, manually-operated transmission.

Simplicity of operation is the outstanding feature of the new transmission, which the manufacturers state has received 500,000 miles of testing on proving ground, road and city streets. It dispenses with the conventional gear-shift lever, substituting a control lever mounted on the steering post below the steering wheel and extending outward to the wheel rim to provide finger tip movement without removing the hands from the wheel. This clears the front compartment for a third passenger. Use of the foot clutch pedal is necessary only when going into reverse or when starting from a full stop.

The driver can move the lever from its neutral position into either one of two forward ranges of gears designated as the "high" and "low" ranges. Within these two ranges are included the four forward gears. As a precaution against accidentally entering reverse, the shift lever may be placed in that position only by pressing a lock button at its extreme end.

Comparative performance figures recorded during tests at the GM proving grounds are shown below.

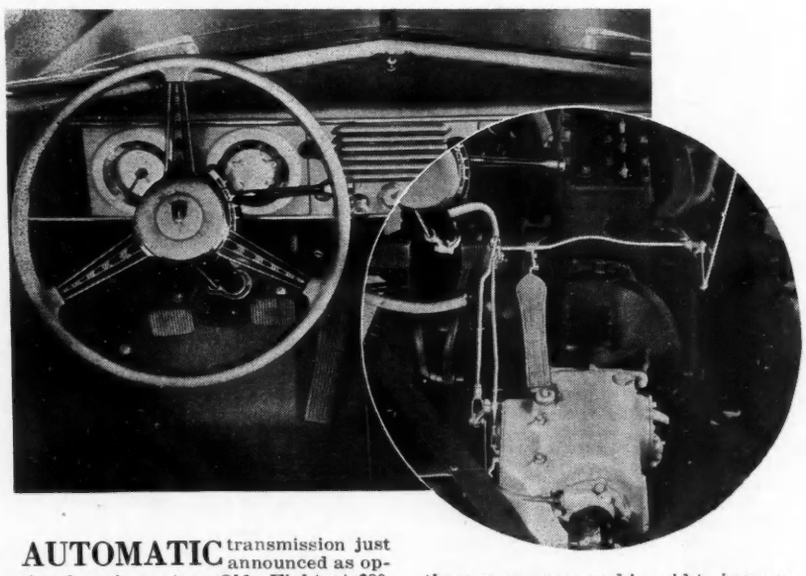
The "low" range includes first and second gear. The "high" range offers first, third and fourth, the first gear being provided in both ranges in order that the driver may, if desired, start in the "high" range when the motor is warm or when the start is not made up a grade. When starting in the "low" range, the driver depresses the clutch pedal, moves the control to the proper point and releases the clutch. As the car picks up, the transmission changes automatically to second gear. Without declutching or releasing the accelerator, the driver then flicks the control to "high range," and the gears automatically progress on through third and into fourth.

When starting directly in the "high" range, similar procedure is followed, except that the gears automatically

(*Continued on page 761*)

	Standard Transmission	Automatic Transmission	Per Cent Gain
Time to accelerate from 5 to 25 m.p.h...	8.25 sec.	7.25 sec.	12%
Time to accelerate from 10 to 60 m.p.h.	19.0 sec.	17.5 sec.	8%
Time to climb 11 per cent hill.....	35.0 sec.	30.0 sec.	14%
Speed at top of 11 per cent hill.....	41.0 m.p.h.	47.0 m.p.h.	15%

Technical description of the new transmission will be published in the May 29 issue of AUTOMOTIVE INDUSTRIES.



AUTOMATIC transmission just announced as optional equipment on Olds Eight at $80. It clears the front compartment for three passengers and is said to improve operation and economy.

ASME Meeting Widely Attended

Joint Sessions with Cooperating Detroit Societies Bring Out Many Papers on Technical Progress

The American Society of Mechanical Engineers held a highly successful and widely attended semi-annual meeting in Detroit this week. The central theme was the achievements of the motor industry and its contributions to other industries. Size of the gathering was indicated by the 800 reservations for the dinner meeting.

H. T. Woolson, executive engineer, Chrysler Corp., and SAE president, was chairman of the papers committee. An interesting feature of the meeting was the scheduling of joint sessions with cooperating societies in Detroit, including the SAE, American Welding Society, American Society of Tool Engineers, and others.

Sessions on Tuesday, the opening day, had much of automotive interest including papers on surface broaching, rubber cushioning devices, and industrial bearing design. The general session that evening dished up a treat in the form of an extemporaneous talk by C. F. "Boss" Kettering, of General Motors Research. In his inimitable manner, "Ket" stripped research of many of its mysteries. "Research," said he, "is an industrial insurance policy with an open premium rate. Whatever the bill is at the end of a year, that's the cost of the policy." Typical epigrams—"Research is something that's too late to do when you want it." "Don't go into new developments unless you are prepared for headaches, because there has never been a new development without its attendant grief after it gets out in the field."

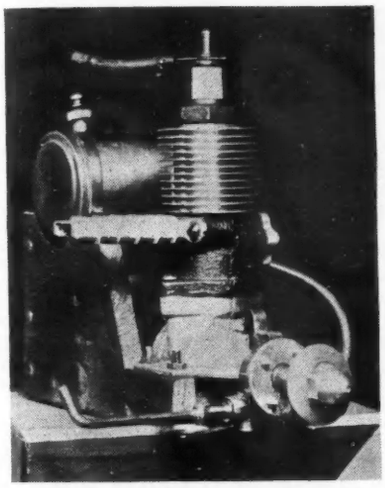
Fred W. Cederleaf, manager machinery division, Ex-Cell-O Corp., approximately presented a companion discussion of the machine tool builders' contributions to mass-production of automobiles, citing that the progress of machine tool and automobile improvements go hand-in-hand but are seldom revolutionary in character. He cited some typical examples of developments in the finishing of cylinder bores and connecting rods to illustrate how engineering refinements follow machine tool developments and create fresh problems for the machine tool builder.

Other sessions included papers on welding, management, deep-drawing steel manufacture, apprentice training and cutting metals research.

At its dinner meeting this week, the American Welding Society launched a new activity, called the Automotive

Welding Council and composed of influential representatives of automotive manufacturing organizations. According to C. L. Eksergian, the council will aid in a cooperative research movement to advance the welding art.

At the ASME banquet Thursday evening, Henry Ford was presented with the Holley Medal of the ASME for his achievements in the engineering field. Alex Dow, past president of the ASME, was presented with an honorary membership in the society.



MODEL aircraft engines are being made in Japan for export with the United States as the major market. The one shown is intended for a model airplane with a five foot wing spread. Its single cylinder has a bore of 0.74803 in. and a stroke of 0.86614 in. Engine speed is from 1000 to 2500 r.p.m. It is rated at 1/6 to 1/5 hp.

Young Heads Buick Plants

Harlow H. Curtice, president of the Buick division of General Motors, announced the appointment of O. W. Young as Buick general manufacturing manager, succeeding the late Charles T. Scannell, and changes in the manufacturing executive staff involving the promotion of seven men.

Mr. Young advances to the head of all Buick manufacturing operations after three years as general superintendent and more than 30 years in the Buick organization, in which he started as a lathe hand.

Other promotions announced by Mr. Curtice were: J. G. Hammond, from superintendent of special transmissions to general superintendent; Mr. Larke from superintendent of the engine factory to assistant general superintendent; Fred W. Letts from assistant superintendent to superintendent of the engine factory; Bruce Fonger from night superintendent to assistant superintendent of the engine factory; R. W. Warnock from general foreman to superintendent of special transmissions; and Vern E. VanSaw from general foreman in the engine plant to assistant superintendent of special transmissions.

Union Moves Against Ford

Opens Campaign Headquarters Near Rouge Plant as Company Begins Defensive Drive; Flint Power Tie-Up Averted

The United Automobile Workers union is gradually closing in on the Ford Motor Co., the last important objective in its drive to organize the automotive industry. Two former branch bank buildings have been leased in the vicinity of the Rouge plant which will serve as campaign headquarters. The drive will be under direction of a Ford organizing committee, comprising the five general officers of the international, Richard T. Frankensteen, organization director, and three Detroit organizers.

Strategy is being developed by the committee. Up to the present time, Ford workers joining the UAW have been registered on union books only by numbers but hereafter names are to be enrolled although membership lists will remain secret. The two branch offices are expected to be ready for occupation by Saturday.

A committee has been studying the Wagner Labor Relations Act and rulings of the NLRB with view of determining whether to file a formal complaint against the Ford company.

Meanwhile Ford opened his defensive campaign by distributing 150,000 "Fordism" cards and pamphlets among the company's workers throughout the United States. In these, Ford outlined briefly his views on unionism. He asked his workers to consider if "it is necessary to pay some outsider every month for the privilege of working at Ford's." "Figure it out for yourself," he tells his men, "if you go into a union, they have got you and what have you got?" A monopoly of jobs in this country is just as bad as a monopoly of bread." Another "Fordism" asks: "What was the result of these strikes? Merely that a number of men put their necks into an iron collar. We're only trying to show who owns the collar."

Answers to the "Fordisms" are easy, says UAW president, Homer Martin.

Plymouth Hit by "Wildcat Strike"

A "wildcat strike" closed the Plymouth Motor Corp. plant in Detroit Thursday afternoon just six weeks after the signing of the Chrysler Corp.-UAW agreement which outlawed strikes for a year. Trouble over an independent organization known as the Industrial Association of Chrysler Employees caused the strike. UAW shop stewards asked the company to discharge the men who had been distributing membersrip cards in the plant, but were refused and a sit-down began. The plant employs 11,000.

Union leaders were in conference with the management and stated that they expected a settlement would be reached so that the plant could reopen Friday morning.

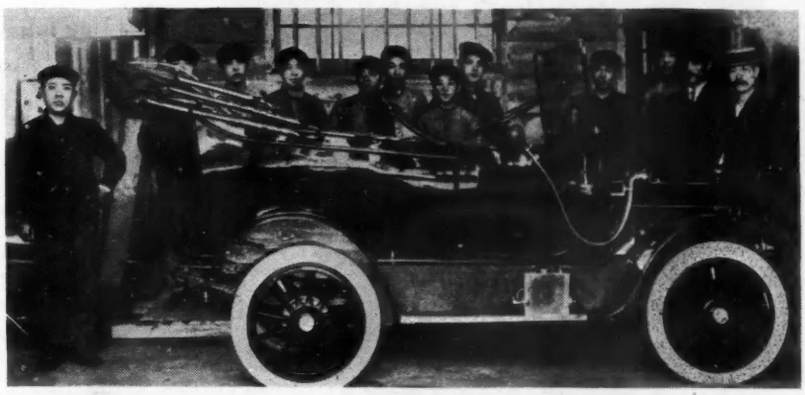
"Organized automobile workers will say, 'We have wage increases (as much as 45 cents an hour in some cases); we have a slower, more humane speed on the line; we are winning a more nearly adequate protection against occupational diseases and industrial accidents; we have job security; and we have our own democratically-controlled union to protect the gains we've made.'

"Ford workers have none of these things—but they're going to get them. Neither Mr. Ford nor his 'isms' will make any impression on his workers," Martin confidently declared. "These employes are the ones that every day encounter his inhuman speed-up and a brutal service department. They aren't fooled by words," was his further comment.

An independent union, known as the Society of Tool & Die Craftsmen, has launched a campaign to enlist skilled craftsmen at Ford's, enrolling only workers employed in manufacture of tools, dies, jigs, fixtures, gauges and machinery. The union already claims 100 members in the Ford plants.

A formal request for revision of the

(*Continued on page 758*)



PROOF that the Japanese automobile industry is not an overnight growth. This is a "Datsun" made in 1914. Its four cylinder engine was rated at 15 hp. Only its wheel rims, magneto, sparkplugs, cord and ball bearings were imported. The reason for the recent awakening of the motor world to the Japanese development in automobiles is the fact that until 1932, car production was part of army ordnance work.

Coolant Dictates Design

Army Approves 1000-hp. Allison V12 Aircraft Engine Built to Use Ethylene Glycol

The new Allison 1000-hp. aircraft engine, which recently passed its type tests at Wright Field, Dayton, Ohio, is probably the first aircraft powerplant specifically designed to be cooled with ethylene glycol, commercially known as "Prestone," a liquid having a boiling point of 387 deg. F. It is also the first liquid-cooled engine of this size to receive an approved-type certificate.

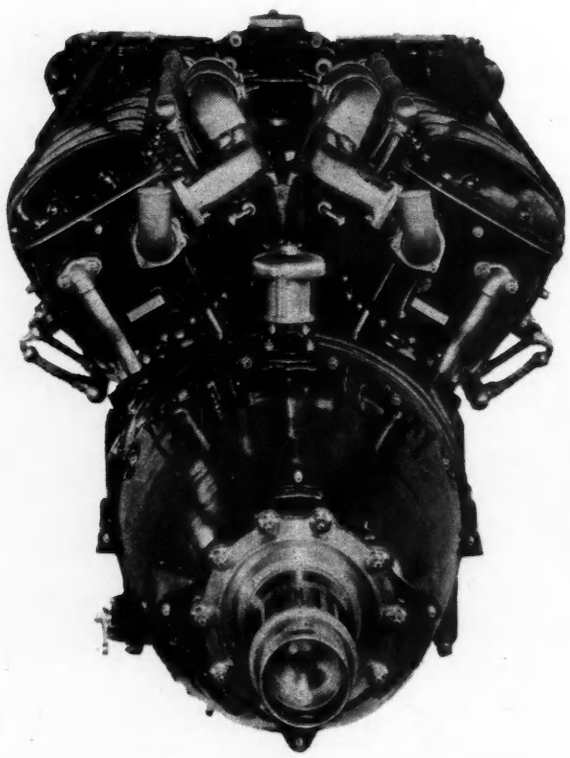
The necessary rates of coolant flow and the temperatures at all points around the cylinders, spark plugs, valve seats, etc., were carefully determined by tests. This high-boiling-point-liquid cooling system is unusually flexible and permits of both tractor and pusher installations of the engine without change in the degree of cooling.

The engine, as already reported in these columns, is a 12-cylinder V design with 60-deg. angle of V; with built-in reduction gear having a ratio of 2:1, and with a centrifugal supercharger which is a part of the accessories housing. It has a cast-aluminum crankcase in two sections, and two cylinder banks, each consisting of a single aluminum-alloy casting containing the combustion chambers and valve mechanism, into which the steel barrels are fitted. The valves, of which there are four per cylinder, are actuated by an overhead, completely enclosed camshaft. Access to the valve mechanism is gained by removing the single cast magnesium-alloy cover extending the length and breadth of the cylinder head. The heat-treated steel cylinder barrels, the valve seats and valve guides are pressed and shrunk into the machined cylinder-head castings. Exhaust valves and valve seats are Stellite-faced.

Each of the two cylinder blocks, consisting of the aluminum head, six steel barrels, and a cast aluminum jacket, is secured to the upper half of the crankcase by 14 long studs extending through the head and into the case. This construction results in the transmission of the gas-pressure forces directly to the crankcase, which latter is stiffened by the truss construction formed by its combination with the cylinder heads and barrels.

Drive to the overhead camshaft is through bevel gears and a long, slender shaft in the upper part of the crankcase, driven from the crankshaft at twice engine speed. This long shaft has a relatively high flexibility and is claimed to damp out torsional disturbances. All surfaces of the conventional six-throw crankshaft are lapped or polished. Its journals are hollow and provided with removable aluminum-alloy plugs. The counter weights are welded to the forged shaft. The pinion of the

(*Turn to page 786, please*)



PROPELLER reduction gear and drives for pumps, supercharger, generator and camshafts of the Allison V 12 designed to be used with liqu'd coolant are shown in this end view of the new aircraft engine.

GM Plans Accessory Plant

Purchase of a 66 acre tract of land in Rochester, N. Y., and plans for the construction of a one-story industrial plant containing approximately 400,000 square feet for the manufacture of automotive accessory equipment have been announced by General Motors executives in Detroit.

The site, bounded by Mt. Read Blvd., Lexington Ave. and the subway property of the city of Rochester, is triangular in shape. The new plant will be started as soon as possible, with manufacturing operations scheduled to start in January, 1938. Approximately 3000 men will be employed ultimately in the plant.

Products made in the new Rochester plant will be shipped to eastern assembly plants of General Motors, including Buffalo, Tarrytown, N. Y., Linden, N. J., and Baltimore. Rochester is also the site of the Delco Appliance Division of General Motors, currently employing 1800.

Gillette Rubber Output Up

Gillette Rubber Co., Eau Claire, Wis., has stepped up production of tires at the rate of 10,000 casings daily and expects to attain 11,000 per day shortly. The daily output of inner tubes is 15,000 units, and, in addition, it is producing 7500 bicycle tires a day. Manufacturing is at an all-time peak, with 2500 at work and a monthly payroll of upwards of $275,000, or at the rate of $3,300,000 a year.

Covered Wagon Has $495 Model

Announcement has been made by the Covered Wagon Company, Mount Clemens, Mich., of a new low-priced steel house trailer to sell for $495, f.o.b. Mount Clemens, Mich. The trailer accommodates four passengers.

The new trailer has an over-all length of 17 ft., an outside width of 6 ft. 6 in., and an inside width of 6 ft. 2 in. Height over-all is 7 ft. 9 in., with 6 ft. 2 in. headroom. The automobile steel chassis is electrically welded and has 6-in. side members with double flanges. Medium carbon steel has been used for tensile strength.

Hupp Appointments Made

Hupp Motor Car Corp. has appointed Grace and Bement, Inc., advertising council. The firm makes its headquarters in Detroit.

Thomas Bradley, Hupp president, announced the appointment of John L. Cotter as secretary and treasurer. For five years Mr. Cotter has been vice-president and general manager of the Crittall Manufacturing Co. of Detroit and Washington, D. C. Mr. Cotter is a specialist in factory operations and industrial accounting.

Mr. Bradley said that Hupp sales will be carried on under the direction of W. A. MacDonald, vice-president. He will at once seek to add dealerships.

March Exports Rise $5,000,000

	MARCH 1937		MARCH 1936		THREE MONTHS ENDED MARCH 1937		1936	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Motor vehicles, parts and accessories	.....	$28,819,207	.....	$23,954,988	.....	$82,379,819	.....	$68,180,704
PASSENGER CARS								
Passenger cars and chassis	22,401	13,121,424	18,792	11,204,998	59,248	35,138,098	50,515	29,371,860
Low price range $850 inclusive	20,520	10,985,285	16,994	9,254,380	54,012	29,360,309	46,089	24,491,819
Medium price range over $850 to $1,200	1,508	1,445,833	1,554	1,495,025	4,233	4,074,171	3,720	3,573,866
$1,200 to $2,000	255	392,040	172	257,291	686	1,061,077	489	686,403
Over $2,000	118	298,286	72	198,322	255	642,541	237	619,772
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	11,082	5,801,801	9,972	4,926,133	34,131	17,890,717	29,625	14,707,791
Under one ton	1,516	552,338	1,282	494,179	4,231	1,585,136	4,194	1,523,175
One and up to 1½ tons	7,619	3,500,885	6,037	2,721,877	24,777	11,291,148	19,399	8,829,963
Over 1½ tons to 2½ tons	1,469	1,054,089	1,527	1,047,967	3,746	2,890,074	3,923	2,772,242
Over 2½ tons	385	614,720	326	373,901	1,041	1,870,441	913	1,129,290
Bus chassis	93	79,789	800	288,209	336	253,918	1,196	453,121
PARTS, ETC.								
Parts except engines and tires	.....	.....	.....	.....	.....	.....	.....	.....
Automobile unit assemblies	.....	5,335,460	.....	4,213,294	.....	16,232,835	.....	13,745,098
Automobile parts for replacement (n. e. s.)	.....	2,784,487	.....	2,118,433	.....	7,891,665	.....	6,029,425
Automobile service appliances	.....	602,788	.....	296,150	.....	1,595,785	.....	1,059,381
Airplanes, seaplanes and other aircraft	41	1,392,238	24	393,048	123	4,024,649	79	1,407,059
Parts of airplanes, except engines and tires	.....	618,060	.....	273,501	.....	1,695,442	.....	951,512
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	56	122,914	38	154,189	180	417,702	109	454,437
Other stationary and portable	.....	.....	.....	.....	.....	.....	.....	.....
Not over 10 hp.	1,438	102,216	1,235	85,333	4,500	281,383	2,724	192,249
Over 10 hp.	209	95,381	425	117,649	541	303,626	874	277,215
Automobile engines for:								
Motor trucks and buses	2,756	285,154	2,984	298,317	8,695	830,568	8,935	855,423
Passenger cars	6,867	488,883	6,206	466,266	25,742	1,744,018	16,969	1,233,636
Engines for aircraft	99	522,447	93	553,072	250	1,460,328	176	893,610
Accessories and parts (carburetors)	.....	257,937	.....	163,273	.....	639,649	.....	472,745
IMPORTS								
Automobile and chassis (dutiable)	109	77,318	40	15,448	356	231,788	149	62,473

Aircraft Sales in Wide Gain

Aircraft sales by the industry for the first quarter of this year gained 67.9 per cent, according to a report by the Aeronautical Chamber of Commerce. Dollar volume was $20,496,517 against $12,207,574. Unit volume was 488 against 354. Commercial aircraft sales were 392 against 183 and military aircraft sales were 96 against 171.

Production for the quarter was 401 commercial aircraft, 93 military aircraft, 800 commercial engines and 484 military engines.

Sales breakdown indicated 168 commercial units in under $1.500 class, 34 up to $2,000, 77 up to $4,000, 50 up to $6,000. 13 up to $10,000 and 50 over $15,000.

Selden-Hahn Plant Sold

The 12-acre plant of the Selden-Hahn Truck Corp., Allentown, Pa., has been sold by the First National Bank of Boston to Max Zweigenbaum, of Scranton, Pa., for $48,000. The purchaser announced that the property was acquired for investment purposes.

Selden and Hahn trucks were manufactured at the plant until 1931, when the equipment was sold to Dallas E. Winslow, who leased the building and has been using it as a servicing plant for Hahn and Selden trucks.

Ball Buys Graham-Paige Stock

George A. Ball, who recently resold control of the Alleghany Corp. with its controlled railroads, has taken up an option to buy 50,000 shares of Graham-Paige Motors Corp. common stock at $3 a share. Mr. Ball, with others, loaned funds to the company some time ago and took the option as part consideration.

Form New Airplane Company

C. G. Taylor and W. C. Young, president and executive vice-president, respectively, announce the formation of the Taylor-Young Airplane Co. The new concern is to take over the business of the Taylorcraft Aviation Co. of Alliance, Ohio. Mr. Young announced that the new company will soon file with the Securities and Exchange Commission a registration statement covering 290,000 shares of $1 par stock, of which 115,000 are to be underwritten and offered at $3 by Hiltz & Co. of New York.

Push Pan American Highway

Completion of the Argentine section of the projected Pan-American Highway linking that country with Bolivia is expected by the end of the year, the National Highway Board of Argentina reports. The road from Buenos Aires to Cordoba—a distance of 530 miles—is already paved and construction work on the section running from Cordoba to the border has been begun.

Foreign Demand Good

Demand for American automobiles is increasing in the Mediterranean countries and in South Africa, said Ward M. Canaday, president of the United States Advertising Corp., returning on the Conte de Savoia after a business trip abroad. He remarked that the demand has naturally centered on the smaller, low priced cars because of the high cost of fuel and taxes. His trip was made for survey purposes.

U. S. New Car Registrations and Estimated Dollar Volume by Retail Price Classes*

	New Registrations				Estimated Dollar Volume			
	March		First Three Months					
	Units	Per Cent of Total	Units	Per Cent of Total	March	Per Cent of Total	First Three Months	Per Cent of Total
Chevrolet, Ford and Plymouth	213,826	58.83	511,575	59.58	$148,000,000	51.73	$354,200,000	52.38
Others under $750	5,321	1.46	11,233	1.31	3,000,000	1.05	6,400,000	.95
$750-$1000	125,241	34.46	288,777	33.63	109,200,000	38.17	251,200,000	37.15
$1,001-$1,500	16,576	4.56	40,324	4.69	20,000,000	6.99	48,500,000	7.17
$1,501-$2,000	1,183	.33	3,173	.37	2,000,000	.70	5,400,000	.80
$2,001-$3,000	1,042	.28	2,803	.33	2,700,000	.94	7,400,000	1.09
$3,001 and over	288	.08	776	.09	1,200,000	.42	3,100,000	.46
Total	363,477	100.00	858,661	100.00	$286,100,000	100.00	$676,200,000	100.00
Miscellaneous	96	.....	584					
	363,573	.....	859,245					

* All calculations are based on delivered price at Factory of the five-passenger, four door sedan, in conjunction with actual new car registrations of each model. The total dollar volumes are then consolidated by price classes. No comparative data with a year ago are available due to the change in the listing of the prices from the old F.O.B. which did not include certain standard equipment, to the new delivered prices which include standard equipment, Federal taxes but no transportation charges.

AMA Meeting June 3

Detroit Again Scene; Show Plans to be Laid

Directors of the Automobile Manufacturers Association will meet June 3 in Detroit, for the adjourned annual meeting. This is the second year the annual meeting has been held in the motor capital because of the press of business in the industry.

Drawing for show space at the National Automobile Show will also take place at the meeting.

Show Drawing Basis Changed

Drawings for space at the National Automobile Show will be based on the same order as last year, not upon the volume of sales this year. The change was made because of the upset in production schedules early in 1937 due to plant strikes.

Association directors will meet Wednesday afternoon, June. 2

How American governments finance highway construction will be explained by Alfred Reeves, vice-president and general manager of the Automobile Manufacturers Association in an address on June 29 at a session of the International Chamber of Commerce, Berlin. Mr. Reeves, accompanied by George F. Bauer, export manager of the association, will leave on the S. S. Manhattan June 16, with the United States delegation.

New Appointments

J. F. Maxwell
. . . is again with Federal Motor Truck as service manager

Robert H. Ahlers
. . . has been given the new post of assistant general plant manager of Pontiac

C. B. Thomas
. . . is now general sales manager of Chrysler Corp., Export Division

Union Moves Against Ford

(*Continued from page 755*)

UAW contract with General Motors will be filed June 11. A meeting of the GM Council of the UAW has been called for June 5 and 6 to discuss revision. This is the same body that met in February to ratify the present agreement and also in January to present the original demands.

Union leaders have been in conference with GM officials over the many "wildcat strikes" that have harassed GM plants during the life of the present agreement. Following the meeting, Homer Martin issued a strongly-worded warning to the various GM locals of the union, pointing out that "the very life of any labor organization depends upon how well that organization keeps its contracts and agreements."

He warned that the International union would not support any group, department or plant going on an unauthorized strike or stoppage of work, advising the use of established procedure for handling grievances.

"We cannot build a union that does not consider its obligations sacred. We have an agreement with General Motors and we must keep it," Martin admonished the locals.

The union will file charges with the company declaring that recognition of the American Labor League, a recently formed independent union, is a violation of the UAW contract with GM. It seeks specifically to have the Ternstedt division withdraw its recognition of a shop committee of the league, an act the union considers contrary to the spirit of the GM contract. E. J. Hanson, works manager for Ternstedt takes the position that "until the UAW establishes itself as representing the majority of our workers, we have to deal with any committee representing employes." Demands for a flat 20-cent increase in hourly rate for tool and die workers, as of Jan. 1, and establishment of a minimum rate of $1.20 for this department were denied. Request that seniority begin on the day of employment instead of after a six-months' probationary period, as now, was taken under advisement.

What might have been a serious stoppage of work in GM plants was averted Wednesday when Governor Murphy intervened to end a strike of 1500 employes of the Consumers Power Co., called by the UAW Wednesday noon. The company serves the Saginaw, Flint and Bay City areas where a number of GM plants are located. All plants in Saginaw and Bay City were forced to close as well as Buick and Chevrolet plants in Flint.

A series of strikes hit the industry this week in violation of agreements with the union. The Meldrum Ave. plant of Briggs Mfg. Co. was involved in a four-hour strike on Monday, started by maintenance men who protested against their wage scale. The strikers agreed to return to work after a sharp reprimand from Emil Mazey, UAW organizer, but the plant was forced to close for the balance of the day because the maintenance men had pulled the fires.

A one-hour strike of employes in the paint shop of Hudson Motor lost them a half day's work and caused several hundred workers in other departments to be sent home Monday afternoon. They returned to work Tuesday morning when negotiations also were started on wage and other complaints.

Plant police promptly ended a sit-down strike of 30 employes of Thompson Products, Inc., Tuesday evening, by releasing tear gas in the department they occupied. The company has a six-months' contract with the UAW, recognizing the union as sole bargaining agency and providing minimum wages and seniority.

A settlement was reached in the two-month-strike of 25 employes of the National Smelting & Refining Co. providing for wage increases and minimum rates. Production was resumed Monday at the American Spring & Mfg. Co. plant in Holly, Mich., with an agreement for providing for wage increases. The plant was closed by a strike April 29. Settlement of the strike in the Detroit plant of the Yale & Towne Mfg. Co. will be included in demands of workers in the Stamford, Conn., main plant according to work received at UAW headquarters from the United Electrical & Radio Workers Union in Stamford. Sitdown strikers in the Detroit plant, which has been closed for two months, were evicted by police and two men are serving jail terms for contempt of court in ignoring an order to evacuate the plant.

Studebaker Closed

All departments of Studebaker except the foundry division closed Wednesday because union members refused to work alongside non-union employes. Approximately 7000 persons were affected by the closing. Company officials and representatives of the UAW

went into conference immediately to effect a settlement. While Studebaker has not a written contract with the union, the UAW has had recognition for the last two years and claims to have about 98 per cent of company's workers in its membership.

A sitdown strike closed the Detroit plant of the Champion Spark Plug Co. Wednesday morning affecting approximately 800 employes. The company maintains that the strike was engineered by a minority group who are members of the UAW. The dispute is over minimum wage rates and an NLRB election to determine the collective bargaining agency.

Some Strikes End

The strike at the Windsor, Ont., plant of the L. A. Young Spring and Wire Co. ended with an agreement giving employes wage increases, seniority rights and premiums for overtime. The UAW is not named in the agreement which is along the lines of the one GM of Canada made with its employes last month.

In Kalamazoo, Mich., striking moulders continued to picket the plant of the Reed Foundry and Machine Co. in defiance of a court order, claiming the company violated an agreement to discontinue a profit-sharing association of employes.

At St. Louis, an agreement was reached between the UAW and GM to drop charges of unfair labor practices brought by the union against the St. Louis units of Chevrolet and Fisher Body. Charges had been filed a year ago with the NLRB after 26 employes were discharged for alleged union activities.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Flying Machine (continued)

By A. M. Herring

Though their theoretical advantages are very great, we are met in the development of the aeroplane or aerocurve machine with difficulties of equilibrium and regulation which until recently seemed well nigh insurmountable.

As a general rule, engineers who have not made a special study of the flying machine question are under the impression that the most important difficulty to be overcome is the obtaining of a very light motor; this is important, but the difficulty has been mastered, both with the steam and the gasoline engine.

The main and most important advance, however, has been that equilibrium is now maintained automatically without the interference of the operator, who may now sit quietly in position.

The sensation in "coasting" through the air is something similar to tobogganing, without the "drop" at the beginning of the glide, for in strong winds one often leaves the hillside horizontally or even on an ascending line. By shifting his weight forward the operator causes the machine to descend. When within 10 or 12 ft. of the ground, by moving easily back to his original position, the machine returns to a level keel and skims along with gradually diminishing speed for 60 to 100 yd. while the operators' feet dangle but a few inches above the grass.

—From The Horseless Age, May, 1897.

Automotive Metal Markets

Steel Market Watchful but Not Unduly Worried Over "Independents'" Labor Troubles

While not unmindful of the possibly dislocating effect on the flow of steel into consumption of the labor troubles that now confront a number of the larger "independent" producers, the steel market this week furnished little, if any, indication of uneasiness over these developments. None of the buying reflected other than routine covering of nearby requirements but there were included, however, some round tonnages supposedly earmarked for initial assemblies of 1938 models.

In some quarters a mild quickening in takings of steel bars is interpreted as presaging another run of good orders from automobile manufacturers to take care of their final current model production program.

Difficulties in obtaining satisfactory deliveries of flat steels have abated. Cold rolled sheets can now be shipped within two weeks following receipt of specifications by the mills. Some sheet mills have on their books a fair volume of third quarter business, but nearly all can accommodate buyers who have attractive specifications to offer. Some of the strip mills complain of a sharp shrinkage in new business but, all in all, a relatively high rate of operations is maintained. Automotive demand for bolts and nuts continues good. With the labor situation what it is and the possibility of interruptions in steel mills as well as in customers' plants to be considered, long range programs are difficult to formulate, and both steel producers and consumers are quite intent upon being in a position to make quick shifts.

Awarding of contracts this week for the construction of another large continuous sheet and strip mill, which will not be ready for operations until next year, proves, however, that the prevailing uncertainty is looked upon as decidedly temporary and that it has not in the least undermined confidence in the future.

Pig Iron—While a revival of export inquiries in Eastern seaboard markets makes for a continuance of higher price talk, the tone of the Middle West markets is rather easy, with shipments to automotive foundries of fair proportions, but fresh buying rather light.

Aluminum—A generally steady tone prevails, routine conditions prevailing in the market for primary aluminum and specialists in secondary metal and alloys reporting a fair run of business at unchanged price levels.

Copper—While statistics indicate a sharp contraction in stocks of refined copper, the general feeling is that production is being stepped up at too high a rate and is likely to result in an over-large supply. Sales so far this month aggregate around 20,000 tons. The export price rules fractionally above the domestic price of 14 cents.

J. D. WRIGHT, assistant to the president of Thompson Products, Inc., for the past four years, has been made secretary of the company.

RAYMOND C. BULLARD, advertising and publicity manager of The Bullard Co., was elected a director at the annual stockholders' meeting.

HARRY M. WHITTAKER has become chief engineer of the Micromatic Hone Corp. of Detroit. He formerly was associated with the Ex-Cell-O Corp. and subsequently headed the Whittaker Engineering Co. of Detroit.

J. J. MOHLER has been appointed Commercial Trailer Sales Manager of the Bender Body Co.

S. W. WARNER was elected secretary of the Timken Detroit Axle Co., to succeed Walter F. Rockwell who remains as vice-president, at an organization meeting of the directors following the annual stockholders' meeting this week at Canton, Ohio.

CHARLES M. YOUNG has been elected president of the L. A. Young Spring & Wire Co., succeeding his uncle, L. A. Young. The new president at 30 is the youngest chief executive in the automotive field. He has been vice-president and treasurer of the company.

LINDEN, N. J. is the location of this large new plant which General Motors Corp. has just put into full scale operation. It is the key Eastern assembly plant for Buick, Oldsmobile and Pontiac.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

Activity in a number of lines of business slowed up last week. The weekly index of business activity compiled by the *Journal of Commerce* stood at 103.6, as against 104.6 the week before and 91.0 a year ago. Consumer buying advanced sharply, and retail trade ranged from 10 to 22 per cent above that a year ago. Some unsettlement was caused by labor disturbances in the steel industry and in General Motors plants.

Carloadings Drop

Railway freight loadings during the week ended May 8 amounted to 767,481 cars, which marks a decline of 14,912 cars below those in the preceding week, a gain of 98,615 cars above those a year ago, and a rise of 192,461 cars above those two years ago.

Power Output up 12.8%

Production of electricity by the electric light and power industry in the United States during the week ended May 8 was 12.8 per cent above that in the corresponding period last year. The largest gain was registered in the Rocky Mountain section, where the rise amounted to 23.7 per cent.

Building Awards Large

Construction contracts awarded in 37 eastern states during April, according to the F. W. Dodge Corporation, amounted to $270,125,200, which marks an increase of 16 per cent above the figure for April, 1936. Residential contracts awarded during April were 61 per cent above those in the corresponding period last year and were the highest recorded since May, 1930.

Total Farm Income Rises

According to the Bureau of Agricultural Economics, cash farm income from marketings during the first quarter of this year ranged from 1 to 29 per cent above that in the corresponding period last year. Government payments received by farmers during that quarter totaled $207,000,000, as compared with only $16,000,000 in the corresponding period last year.

Oil Production Off

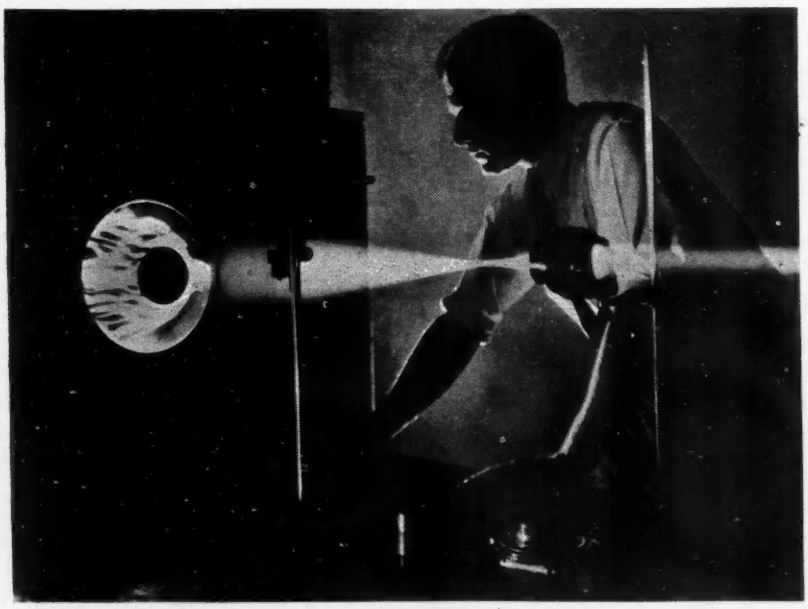
Average daily crude oil production for the week ended May 8 amounted to 3,489,200 barrels as against 3,497,450 barrels for the preceding week and 2,961,700 barrels for a year ago.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended May 15 stood at 92.7, as compared with 93.3 the week before and 93.5 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended May 12 showed a decline of $1,000,000 in holdings of discounted bills and an increase of $1,000,000 in bills bought in the open market. Holdings of government securities remained unchanged. Money in circulation declined $21,000,000, and the monetary gold stock increased $44,000,000.



INTRICATE set-up in the General Motors Research Laboratories permits engineers to study visually the flow of air around scale model objects of any shape. The projected image of the object and flow of air is called the Schlieren effect.

Small Dealer Stocks Curb Sales

(*Continued from page* 753)

Deliveries of White and Indiana trucks in April totaled 1,301 units, the largest number of any like month since 1926, reported President R. F. Black to stockholders at the adjourned annual meeting this week. Mr. Black said that deliveries for the first four months of the year numbered 4,219 units against 3,305 for the 1936 period, also a high mark since 1926.

Mr. Black told stockholders that the $2,000,000 plant improvement and enlargement plan has been begun. At the meeting, stockholders approved capital readjustment plans which will wipe out a balance sheet deficit.

Studebaker Corp.'s sales for the first ten days of May were 2419 cars and trucks, against 2110 in the 1936 period, reported President Paul G. Hoffman. Sales for the year to date were 40,340 cars and trucks against 33,413 last year, a gain of 21 per cent.

:SLANTS:

5 MP. VS. 16 HP.—*Five rikisha pullers who were "traded in" on a new "Datsun" car by a Japanese firm of billbrokers, are seeking All-Japan Federation of Labor's aid to get their jobs back. They say they are just as efficient. It is said that rikishas today are used to carry geishas and their best clients, the bankers. The firm is considering the matter.*

FIFTEEN TONS *is the designed load for each of the huge airplane tires now being manufactured by the B. F. Goodrich Co. for use on the new 40-passenger Douglas ships, first of which is nearing completion at Santa Monica, Calif. The tires are five feet five inches in diameter and two feet across at the base. Tires weigh 360 lb., tubes 45 lb.*

MEDALS—*The Canadian copper alloy used in 1937 Ford V 8 radiators was the material selected for making 50,000 coronation medals which were the Ford Motor Co. of Canada, Ltd.'s contribution to the Empire celebration last week. The medals carry profiles of the King and Queen, and an inscription.*

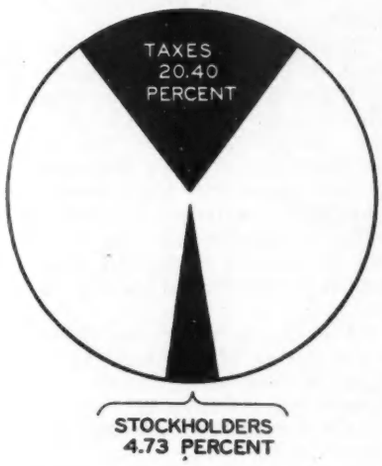
Brace Filter Adds Space

Brace Oil Filter Co., Milwaukee, manufacturer of oil filtering devices for automobiles, trucks, tractors and aircraft, has leased the fifth floor of the Wellauer Building at 234 North Broadway, Milwaukee, with 15,000 sq. ft., to double its production facilities.

Bender Body Has New Model

The Bender Body Co., is bringing out a new steel trailer model with a base price of $465.

Taxes Absorb Large Slice of Oil Company Receipts



The chart shows that the tax collector last year received a very large proportion of the oil companies' revenues from the sale of products. Stockholders received in dividends only about a quarter of the tax bill. About three-fifths of the receipts went for wages, materials and similar cost items. The companies retained for new working capital almost exactly the same amount as was paid out in dividends. The rest went for depreciation, depletion and interest.

Olds Offers Special Transmission

(*Continued from page* 754)

progress from first to third to fourth. The change into fourth is made at a road speed of 22 miles per hour.

The fourth speed, known also as the "super drive," is one of the most important features of the new transmission. It is not an "over drive," but is a special direct drive providing an extremely low ratio of engine speed to road speed which makes possible a fuel saving of between 12 and 18 per cent.

Another feature of the new transmission is the third or "pick-up gear" which provides added power reserves for hill climbing or for acceleration up to 55 miles per hour. At speeds below 50 miles per hour, the driver may drop from "super drive" fourth into the "pick-up" third gear merely by pressing the foot accelerator to the limit of its downward travel. When the accelerator is released slightly or when car speed reaches 55 miles per hour, the transmission automatically returns to "super drive."

The third and fourth gears "straddle" the ratio of the average third gear in general use today, which is in the neighborhood of 4.4 to 1. In the Oldsmobile automatic transmission the ratio of third gear or "pick-up gear" is 5.1 to 1, while fourth gear or "super drive" ratio is 3.55 to 1.

At speeds below 30 miles per hour, the driver may use the compression of the motor as a brake in descending hills merely by flicking the control lever to the first forward position or "low range," without declutching. This engages second gear which serves to control down-hill momentum exactly as in the conventional type of transmission. This flexibility of control adds greatly to safety when driving in mountainous country or on slippery roads.

Companies Report

General Motors Details Results for First Quarter—Packard, Willys Have Profits

Alfred P. Sloan, Jr., signing his first quarterly report as chairman of the board of General Motors. stated that the two reasons for a decline of but 15 per cent in net income during the strike period were control of expense and acceleration of output in March.

In the detailed quarterly report, depreciation charges for the first quarter were put at $10,377,818 against $9,287,807 for the 1936 period. There was no other breakdown of operating costs. Net income, as reported in preliminary form late in April, was equal to 99 cents per common share for the March quarter, against $1.17 per share for the March quarter of last year.

The balance sheet of March 31 showed sharp increases in cash, trade receivables, sight drafts B/L, and inventories, compared with the figures for Dec. 31, 1936. Comparisons with the balance sheet of March 31, 1936, also showed increases. Cash alone was $221,094,006 against $188,559,023 on Dec. 31, sight drafts B/L were $12,416.253 against $9,859,407, net trade receivables were $77,948,485 against $69,899,699, and inventories were $253,591.394 against $225,644,813. Total current assets were $568,608,987 against $513,986,449 on Dec. 31, while total current liabilities were $190,315,719 against $174,299,898. The increase in current liabilities was principally in accounts payable, and the item of taxes, payrolls and sundry accruals.

The balance sheet also showed an increase in contingency reserves to $38,356.520 from $34,568,240 three months earlier. Such reserves a year ago were $23,711,552.

Reports of other companies, for the March quarter unless otherwise indicated, were as follows:

Packard

	1937	1936
Net income	$2,610,701	$1,248,029
Per share	17¢	8¢

Willys-Overland
(6 mos. ended Mar. 31*)

Net income	$155,666	....
Per common share	3¢	....

*Initial semi-annual statement after reorganization.

Motor Wheel

Net income	$460,423	$370,014
Per share	54¢	43¢

Hercules Motors

Net income	$177,696	$111,438
Per share	57¢	36¢

Caterpillar Tractor
(4 mos. ended April 30)

Net income	$3,981,034	$2,828,451
Per share	2.06	1.50

Continental-Diamond Fibre

Net sales	$1,956,511	$1,532,221
Net income	181,188	45,719
Per share	40¢	10¢

Large Fleets' Gross Best

(*Continued from page* 753)

At the time of the survey, October, 1935, only 27.9 per cent of all units reported in use were five or more years old. Forty-two and eight-tenths per cent were two years old or less. Generally, trucks and trailers were older than tractors and semi-trailers. Of the tractors 63.5 per cent were two years old or less. In the same age group were 54 per cent of the semi-trailers, 37.7 per cent of the trucks and 35.7 per cent of the trailers for which detailed data was available.

By far the largest group of employes of the trucking-for-hire concerns was the transportation crews. These numbered 67.8 per cent of the total number and they received 62.8 per cent of the payrolls for the representative week selected for census purposes.

PUERTO RICO

has its traffic problems as this street scene in San Juan shows. There are about 19,000 cars and trucks registered on the island. Narrow streets in the old city are not indicative of general road conditions since there are over 2200 miles of good roads at this time. Sales for the current fiscal year will probably reach 4000 vehicles.

Firestone in Detroit Area

Although officials of the company decline to confirm the report, it is reliably reported from Detroit that the Firestone Tire & Rubber Co., of Akron has acquired a tract of nearly 100 acres at Riverview, Mich., and will erect a plant for the manufacture of rubber parts, other than tires and tubes, for original equipment use on automobiles. Foundation work is to start shortly. Firestone is reported to be speeding the installation of new machinery in its new Memphis, Tenn., plant and to plan for a rapid step-up in tire production there.

The Firestone plant at Riverview, Mich., it is understood, will be similar to that which the B. F. Goodrich Co., recently established at Cadillac, Mich. This Cadillac plant is used exclusively for rubber parts for automobiles.

Tire Price Upset Feared

The tire industry appears to be gravely concerned over trends in the retail market which threaten, if they persist, to upset the industry's price stabilization program which has been working so effectively since Nov. 1, 1935. It is the consensus of opinion that the program faces its most severe test between now and Memorial Day. The week preceding the Memorial Day holiday week-end customarily is the heaviest tire buying week of the year as more motorists tour over this holiday than any other of the year. Prior to the adoption of the industry's price stabilization program, the days preceding Memorial Day usually were characterized by wild price cutting, special discount sales, free tube offers, exorbitant trade-in allowances, etc., with the mail-order houses setting the pace. Last year the industry withstood the test without any major upsets in the price structure.

This year, however, the situation appears to be different. Mass-distributors have shown an inclination to capitalize price reductions and the road hazard guarantee in their advertising. Dealer prices in several metropolitan markets already have weakened as result of such advertising.

Manufacturers held a special meeting in New York with the Rubber Manufacturers Association May 14 to discuss the price and guarantee situations.

Dividends Declared

		Record	Payable
Burd Piston Ring	q 25¢	May 15	June 1
Ford Motor, Ltd.*	21.3¢	April 30	May 19
Monroe Auto Equipment.	25¢	May 20	May 25
Muskegon Motor Specialties ...	$1.50 pfd. A	June 1	June 5
Twin Disc Clutch	ext. 25¢	June 15	June 25
Twin Disc Clutch	q 75¢	June 15	June 25
Yellow Truck	q $1.75 pfd.	June 15	July 1

*Amer. deposit receipts for ord. shares.

NADA Catechizes Industry

Is the automobile industry willing and able to regulate itself, or should the job be turned over to the government?

This question is asked in the current issue of the official bulletin of the NADA which has headquarters here. On the front cover page is the following statement, under the heading, "Storm Signals." "The Congress of the United States has been asked to investigate the automobile manufacturer-automobile dealer relations to the end that the present unfair and inequitable conditions harmful to the consumer be rectified."

"A state legislature has ordered an 'investigation of the business dealing in and selling motor vehicles—for the purpose of ascertaining if the public will be benefited by the regulation of the business.'

"A state is considering the advisability of permitting the establishment of dealers only on the basis of 'convenience and necessity.'

"Is this the beginning of a new era? Is this industry willing and able to regulate itself or should the job be turned over to the government?

"The automobile dealers in America will decide."

Buick May Sales Over 1936

Buick domestic retail sales for the first ten days of May were 6508 units against 4903 in the like portion of 1936.

Calendar of Coming Events

SHOWS

Second Annual Automobile Maintenance Show, San Francisco.....May 20-23
Morocco, Automobile Section, Tangier Fair, Tangier .....June
France, Automobile Section, Bordeaux Fair, Bordeaux .....June 13-28
Belgium, First International Aeronautical Salon, Brussels.....June 18-30
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London....Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
National Automobile Show, New York, Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Buffalo, N. Y., Automobile Show, Oct. 30-Nov. 6
Cincinnati Automobile Show.Oct. 31-Nov. 6
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Chicago Automobile Show.....Nov. 6-13
Akron Automobile Show.....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Brooklyn Automobile Show.....Nov. 6-13
Columbus Automobile Show.....Nov. 6-13
Detroit Automobile Show.....Nov. 6-13
Kansas City, Mo., Automobile Show, Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J.....Nov. 6-12
Newark, N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13

Show Business

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Pittsburgh, Pa., Automobile Show.Nov. 6-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Jersey City, N. J., Automobile Show, Nov. 13-20
Milwaukee, Wis., Automobile Show, Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show.Nov. 14-21

CONTESTS

Indianapolis Speedway, 500-Mile International Sweepstakes .....May 31
31st Annual Grand Prix of the Automobile Club of France, Linas-Montlhéry .....July 4
Roosevelt Raceway, 300-Mile George Vanderbilt Cup Sweepstakes (Rain date July 5) .....July 3
National and International Soap Box Derby Finals, Akron, Ohio.....Aug. 15
Pan American Cup Race, Roosevelt Raceway .....Sept. 6
National Outboard Championship Regattas, Richmond, Va.....Sept. 18-19

CONVENTIONS AND MEETINGS

American Society of Mechanical Engineers, spring convention, Detroit, May 17-21
National Association of Purchasing Agents, 22nd Annual Convention, William Penn Hotel, Pittsburgh, Pa. .....May 24-27
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .....June 1-3
Second World Petroleum Congress, Paris, France .....June 14-19
Automotive Engine Rebuilders Association, 15th Annual Convention, Chicago .....June 21-24
American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2
U.A.W. Annual Convention, Milwaukee, Aug. 23
American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va.....Sept. 19-23
S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ...Sept. 30-Oct. 1
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
S.A.E. Annual Dinner, Commodore Hotel, New York.....Oct. 28
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 9-12
S.A.E. National Production Meeting, Flint, Mich. .....Dec. 8-10

Just Among Ourselves

Spotlight on Dearborn

EQUIPPED with a new campaign plan and heartened by the series of agreements with General Motors, Chrysler, Hudson and Packard, the United Automobile Workers International Union announced May 18 the official beginning of a move to force working agreements with the Ford Motor Co.

Several weeks ago, during the height of the General Motors strike, union banners screamed "Ford next." Since then, there have been sporadic outbreaks of labor trouble in Ford assembly plants, but no evidence of any concerted plan behind them.

Ford assembly plant managers have been willing to talk about anything but labor. Sole pronouncements of policy on the subject have emanated from Henry Ford, who has been positive and clear in his position. To W. J. Cameron on the Ford Sunday evening radio hours has been entrusted the task of putting the public right on the general questions involved. In this, by available evidence, he has been conspicuously successful.

The union realizes, as everyone must, that dealing with the Ford Motor Co. is an entirely different problem from negotiating with a corporate body which must consider the interests and emotions of thousands of its stockholders in addition to public sentiment in its broader aspects.

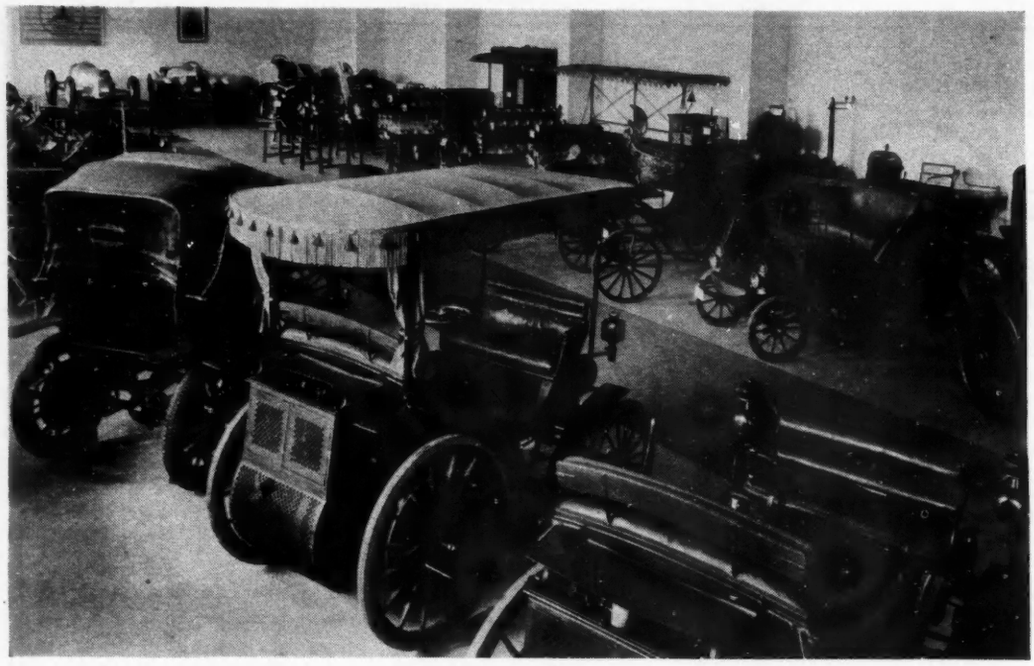
The wishes of Mr. Ford are the policy of the Ford Motor Co. The voice of Mr. Ford is the means by which policies are enunciated. The person of Mr. Ford is the public symbol of the whole organization.

Working out of Ford strategy is in the hands of a few men, responsible to no one but Mr. Ford. Policies and plans can be shifted overnight, decisions can be made quickly. Tremendous resources can be brought to back them through the agency of one man's signature.

The Ford organization, menaced by the lengthening shadow of the Wagner act, is meeting union propaganda with counter propaganda of its own, not on the issue of whether the UAW should have sole bargaining rights in the Ford plants, because the UAW admittedly does not yet have sufficient strength in Ford plants to risk a vote on the question; but on the more fundamental issue of what the men have to gain by joining the union. Because of this situation, Mr. Ford is one-up on other automobile companies which began the battle from the point where the union had already gained sufficient strength to risk a decision round.

What will be the outcome of labor's fight to organize Ford? If the unions can gain enough members inside the organization to force an NLRB election or tie up the plants with a strike the outcome will probably resemble those which have just passed. If Mr. Ford can convince his workmen that the union will do them no good, it may be possible to maintain the Ford Motor Company's plants as oases of open shop procedure. While the situation is in the present stage, Mr. Ford packs powerful artillery. He can adjust wages and hours, and import workmen from undefiled centers of free American enterprise, to replace those who show tendencies to put their necks in the union's noose. If the union keeps its membership rolls among Ford workers "secret," nobody can be "Wagnered" for firing a man for union activity, when the union won't admit he's a member.

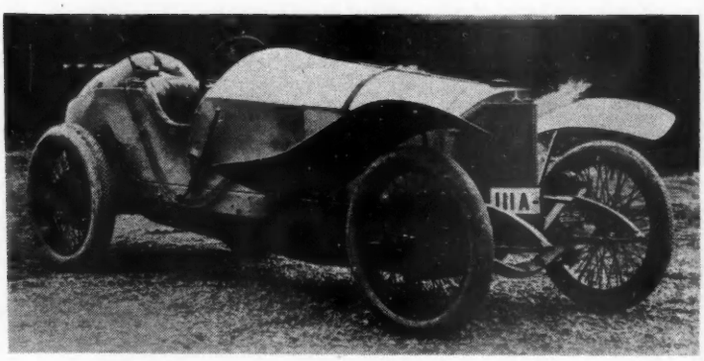
—H. H.



General view of the Mercedes-Benz automotive museum at Stuttgart. Note the current model racing car in position of honor

Stuttgart Museum a Complete Record

ADJOINING the modern showrooms of the Mercedes-Benz Company at Stuttgart is the most complete automobile museum in Europe and the only one in which the automotive chain of evolution is shown unbroken. Automobile manufacturers usually throw their obsolete models on the scrap heap—and regret it afterwards. The Mercedes company appears to have made it a practice, from the beginning, to hold at least one of each model signalizing an epoch in automobile engineering, with the result that they now possess a collection of all outstanding types, from 1884 to 1937. The Benz company came into existence about the same time as the Daimler company, but the early Benz cars were allowed to be scattered, only a few isolated models finding a refuge in national museums, with the result that when Mercedes and Benz united forces a few years ago, the latter firm could not supply much to the museum.



1914 Mercedes racing model now in the Mercedes-Benz museum at Stuttgart

When Henry Ford visited the Mercedes-Benz museum he inquired, "How much is it worth?" Dr. Schippert, president of the company, smilingly replied, "Dollars could not buy it." But even though no monetary value can be placed on this collection of about 150 historic cars, it undoubtedly has a real commercial value, for the prospective client who wanders from the display of 1937 models into this hall of glorious relics cannot but be impressed by the value of the cumulative experience represented by these 53 years of automobile engineering.

The oldest exhibit is a wood wheel, wood frame motorcycle built by Gottlieb Daimler in 1884. It has a vertical single-cylinder engine which the rider must straddle and the drive is by means of a belt and ring gear to the rear wheel. There is a belief that this machine is a dummy and that it never ran on the road. The engine, however, certainly was tested and ran on the bench.

At this period transmission problems were even greater than engine problems, which explains why some of the earliest applications were not to road vehicles. The exhibition contains a motor boat, formerly owned by Otto v. Bismarck, fitted with a single-cylinder engine and dating from 1888. In the same year a railroad inspection car was built and also several street cars, which were put into service at Bremen, the passengers being carried in two rows, back to back, and the driver precariously mounted astride a plank.

# of Automotive Progress

The single-cylinder motor was followed by the famous Daimler twin-cylinder V model, licenses for the construction of which were secured in various countries. Some of these are in the museum. Some of the earliest Daimler automobiles are missing, one of the first, produced in 1886, being at the Munich Museum. The factory museum, however, has an 1890 model with horizonal engine, chain drive and the front wheels mounted in bicycle type forks, with tiller steering. The various fluctuations, from steering wheel to tiller and back to steering wheel, with the engine mounted in different ways at the rear, are shown on the original models. In 1894 the engine was vertical at the rear, with steering by tiller. In 1895 the engine was in the same place with steering by means of a wheel. But the 1900 model was a real epoch maker, with engine and radiator in front, side chains, and steering wheel—the general line of construction which was to be followed for a long number of years. In 1901 came the type of body known as the "tonneau," or open tourer, which also remained unchanged, in principle at any rate, for nearly 20 years.

The first shaft drive in the Mercedes museum dates from 1909, for the German engineers long maintained that side chains gave better riding and greater reliability. In the same year is a Daimler car with one of the sleeve valve engines invented by Charles Y. Knight, for which the German firm had secured manufacturing.

Apparently the ex-Kaiser had time for hunting even during the World War, for the museum contains the Royal shooting car of 1917, complete with the Imperial crown. The first truck dates back to 1891. It has the motor under the seat, driven by means of two belts, and wood wheels with steel rims.

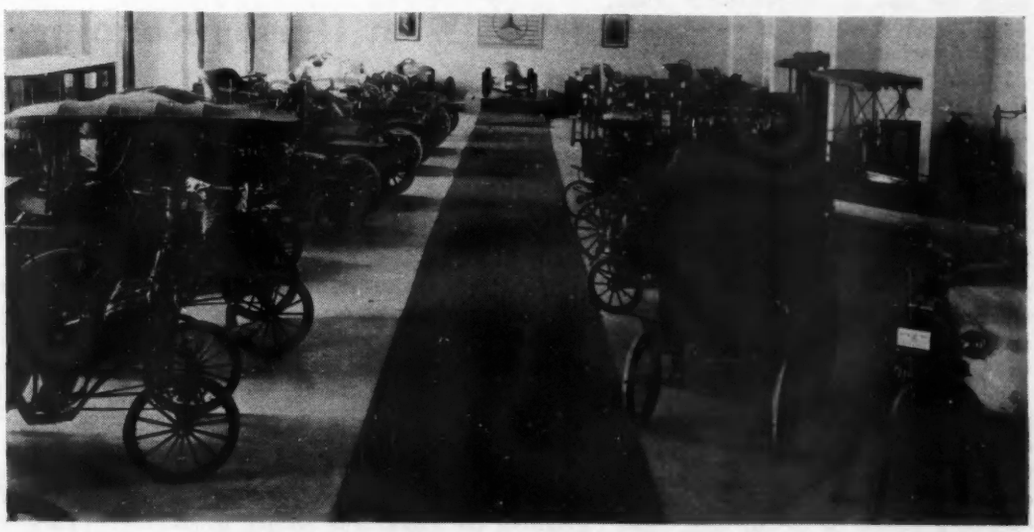
Racing cars typify engineering progress. From the 1906 "square engine," side chain model, the exhibits jump to the 1914 type which won first three places in the French Grand Prix a few weeks before the outbreak of the World War. With its steel cylinders, welded on jackets, four valves per cylinder, single overhead camshaft and shaft drive, this was the most advanced racing car of its period, lacking only the front wheel brakes which had just made their appearance on some French cars. Another epoch-marking car was the rear engine Benz of 1922. In 1923 the supercharger and front wheel brakes had come with the Targa Florio winner. In 1924 the racing model had a straight eight engine, with Rootes type blower and four wheel brakes; finally the 1936 Mercedes racer occupies the position of honor on a pedestal, flanked by the portraits of Carl Benz and Gottlieb Daimler, the respective founders of the Benz and Daimler companies.

Aviation is well represented. The first engines used on German planes in the world war were practically identical with the six-cylinder racing engines of 1913, one of which was handled by Ralph de Palma, at Indianapolis, in 1914. Each of the outstanding models has its place in the museum, together with ignition devices, carburetors and notable transmissions.

No other European manufacturer appears to have attempted to maintain a comprehensive museum. In a few cases old models have been bought back from private owners, but they do not constitute a chain of cars showing the evolution of automobile engineering, such as the Daimler-Benz company possesses.

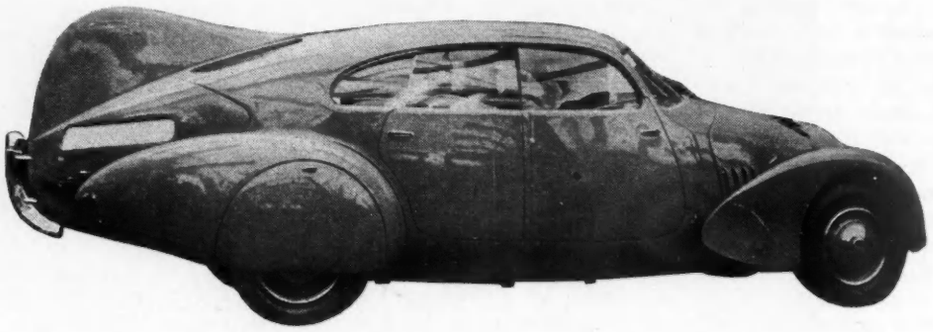
Even the national museums are very incomplete. Cugnot's steamer (1770) is preserved in the Conservatoire des Arts et Métiers, at Paris, together with a few more modern automotive exhibits. At Compiègne there is a carriage museum, containing more horse-drawn than mechanical vehicles. Other museums have isolated models of old cars. *(Turn to page 782, please)*

By W. F. Bradley



Along the line of development with many times and many types

Streamlined Body Designed by Andreau



IN our report of the Paris Salon we published a photograph of a Peugeot car with a highly streamlined body developed by M. Andreau. The car was presented by the Peugeot firm as "the automobile of the future," and few details were obtainable regarding it, but M. Andreau later presented a "Note" on the subject to the French Society of Automobile engineers.

The problem that confronted M. Andreau was to develop a body that would show minimum air resistance, that was to be fitted to a stock chassis, on which latter nothing was to be changed, and that would form a comfortable vehicle having good visibility and meeting all of the conventional automobile requirements. It was stipulated, moreover, that its appearance should not be "deceptive."

A body of normal floor shape was adopted, accommodating a three-passenger front seat and a two-passenger rear seat, the front-seat width being the same as on the Peugeot stock car. The beetle-shaped front was obligatory. The stock car had an air-resistance coefficient of 0.00174, which is already quite low, as earlier models had a coefficient of 0.0020 to 0.0022. The new streamlined car has an air-resistance coefficient of only 0.00072, that is to say, its air resistance is 65 per cent less than that of the conventional car and 58 per cent less than that of the Peugeot Model 402. The figure of 0.00072 was checked in three ways, viz., by calculation in the course of the development work; by tests of models in the Chausson wind tunnel, and by deceleration tests on the track between 70 and 55 m.p.h. The three values obtained agreed within 5 per cent. The result of this streamlining is an increase in the maximum speed of 30 per cent and a decrease in fuel consumption at normal operating speeds of 30 per cent. The gain in economy should really be greater, but it is held down by weight, the body being of composite construction, and, besides, by the increase in the specific consumption of the engine for low load factors. M. Andreau observes in substance that if the same gains had been sought by changes in the engine alone, it would have been necessary to develop a design of 30 per cent lower specific consumption and 120 per cent more power, which he believes to be impossible of attainment.

The designer claims for this car that moments of air resistance are eliminated, and that the car is insensitive to transverse winds. As a matter of fact, it was possible in a side wind of 45 to 50 m.p.h. to drive safely at a speed of 70 m.p.h., without lurching and without pull on the steering wheel. On the same day the most powerful vehicles were limited to 37-43 m.p.h. and lurched a great deal. It is possible to release the steering wheel even at quite high speeds without anything in particular happening, and the fatigue of driving is therefore greatly diminished, so that safety is enhanced. It is easier to take turns, because the car no longer has to struggle against an air-resistance moment, which with normal designs opposes a change in direction.

The problem of an overdrive or, alternatively, of a four-speed transmission with direct drive in third was studied, and after road tests, in which 85 per cent of the driving was done in the overdrive fourth speed, the last-mentioned alternative was found to be the best for country driving. It is the most economical in any case, and above 30 m.p.h. it assures sufficient acceleration in most cases.

Effect of Colloidal Graphite on Piston-Ring Wear During Running-In Period

TESTS to determine the effect of colloidal graphite in the crankcase oil on the rate of wear of the piston rings and the cylinder bore, as compared with the rate of wear when plain mineral oil is used as luricant, were made by the Research Department of the Institution of Automobile Engineers, and a report outlining the method of test and giving the results obtained was issued by the Institution. We are informed that the wear recorded was that on the piston rings, rather than the wear of the cylinder bore, because the former can be more easily and more accurately determined by weighing the rings. The results, moreover, were checked by analyses of the metal contents of the crankcase oil.

In the tests referred to, the engine was run for 15 minutes and then allowed to rest for 15 minutes. This cycle was repeated 180 times. During the first five minutes of the running period the engine run under light load at 1000 r.p.m., and the cylinder wall reached a temperature of 122 deg. F. Both the load and speed were then increased, the latter to 2000 r.p.m., and during the remainder of the run the cylinder wall temperature rose to 212 deg. F. These conditions accentuate the factors which give rise to wear in

(Turn to page 782, please)

Centrifugal Clutch

Embodies new intermediate mechanism to assure free idling and positive drive to all operating speeds

THE shoe-type centrifugal "main" clutch which has been developed for use with the Monodrive automatic transmission embodies a number of interesting features. Fig. 1 herewith shows the clutch in the form in which it is fitted to Yellow coaches with rear-mounted powerplant.

An automatic clutch for this service naturally involves a number of difficult design problems, as the clutch must allow the engine to idle freely and yet must hold firmly at a speed not greatly exceeding idling speeds, because if much higher speeds were required to enable the clutch to carry the full engine torque, there would be much slipping and consequent excessive heating. In the past, centrifugal clutches generally have been of the disk type, but the clutch here described is of the internal-shoe type. The clutch drum is made of cast iron and its outer surface is coated with a heat-sensitive lacquer which shrivels when the temperature of its base exceeds 300 deg. Fahr. It is stated that, provided the proper kind of lining is used, no discoloration of the paint ever occurs in service.

To withstand the high pressures to which they are subjected, the linings must be hard and must not squeeze out. They must have a high coefficient of friction and must be oil and heat-resistant. The linings actually used have a friction coefficient of 0.35 when dry and 0.10 when operating in oil. During the experimental period three different types of lining were tried. One proved entirely unsuitable for the purpose and was abandoned almost immediately; another lining gave fair service, while the third, a standard woven and compressed type with brass-wire mesh, proved entirely satisfactory. After 25,000 miles of service on the first coach the lining was worn down (or compressed) only 0.005 in., while the drum was polished but showed no wear.

Referring to the assembly and sectional views reproduced herewith, the clutch has two internal shoes *A,A* which are expanded by the centrifugal force on governor weights *B,B* with their connecting linkage and two pressure springs *C,C*. The clutch drum with which the shoes contact (and which is not shown in the drawings) forms part of the transmission assembly. The two centrifugal weights are connected by two pairs of primary toggles *D,D* and the equalizer *E* to two pairs of secondary toggles *F,F*, each of which connects adjacent ends of the two shoes, the toggles expanding the shoes as they straighten out.

The clutch starts to engage at about 400 r.p.m. of the engine, and the maximum effort of the weights is reached at 800 r.p.m., at which speed the clutch is fully engaged. Any additional pressure of the shoes against the drum is due to centrifugal force on the shoes themselves. The drum is 16 in. in diameter and 3¼ in. wide.

Since there is a slip period between engine speeds of 400 and 800 r.p.m. when the car is being accelerated, excessive slippage is prevented by pushing the accelerator pedal down without hesitation. Once the clutch has taken hold, it remains firmly engaged until the speed drops again to 400 r.p.m., when it "snaps" out of engagement. This rapid disengagement is due to the fact that the clutch is locked in by the toggles *F,F*, which are nearly straight and thus prevent the reaction of the pressure springs *C,C* from being transmitted to the centrifugal weights *B,B*. The latter are provided with torsion springs *H* surrounding their hubs which

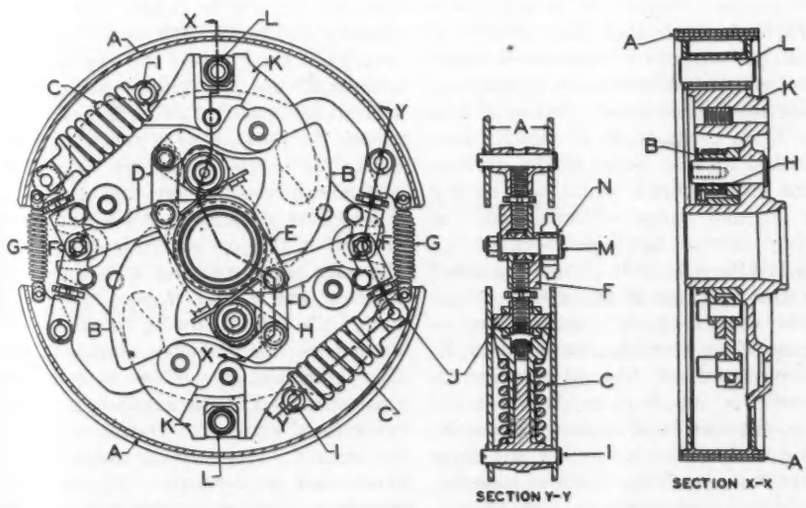


Fig. 1—Shoe-type centrifugal clutch used on Yellow coaches with rear-mounted engines

return them to their inward position. The pressure springs *C,C* are preloaded to approximately 1400 lb. each in the "off" position, and the anchor ends of these springs are pinned to the shoe at *I,I*. The roller *J* at the toggle end creeps on the inner face of the shoe *A* and is able to compensate for wear of the lining.

Engine torque is transferred from the flywheel spider plate *K* through a centrally located trunnion block *L* to the shoe. The toggles *F,F* merely serve the function of expanding the shoes *A,A* into the engaged position and to increase the force of the pressure springs *C,C* and the force of the weights *B,B* during this period. The range of travel of the weights is limited by a stop. The secondary toggle pin has a head extension *M* on which is mounted a sleeve roller *N* centered in a radial slot of the spider *K*. The shoes *A,A* are thus centralized, and a definite clearance relationship between the lining and drum is maintained for idling. The retraction springs *G,G* help in this.

The shoes are turned down to a radius 0.015 in. smaller than the radius of the drum, in order to obtain easy initial engagement. Before the full spring pressure is exerted, the contact is extended over 90 deg. of arc. Full contact is obtained by distorting the shoe, whose rib contour is specially designed with this end in view. Chatter and grabbing are eliminated by this gradual increase in contact area. The pressure springs *C,C* are compressed to approximately 1600 lb. each by the toggles, and the quick release when the engine speed drops to 400 r.p.m. is due to the withdrawal action of the weight-retracting springs *C,C*, which snap the primary toggles from their (near) dead-center position.

The effective mass of each centrifugal weight *B* is only 4 lb. The effective radius of the weights increases as the weights move out from the axis of rotation, and the force on them is multiplied by the double toggle mechanism and added to by that of the pressure springs. Owing to this arrangement, the weights are able, at an engine speed of 800 r.p.m., to transmit the full engine torque of 450 lb.-ft. at this speed. Access to the four star wheels on the secondary toggles may be had through the cover plate on the clutch housing. These star wheels are the only adjusting means on the clutch and serve to compensate for lining wear.

The same general type of clutch has been developed also for use with sliding-gear transmissions. Heretofore this type has been considered unsuitable for that purpose, on account of the large moment of inertia of its driven member, but the provision of a jaw clutch, which is clearly shown in the axial section in Fig. 2, has overcome this objection. The advantages claimed for the use of an automatic clutch of this type with a conventional sliding-type of transmission are that it renders its operation easier and makes the shift quieter and the pick-up smoother than with the conventional clutch.

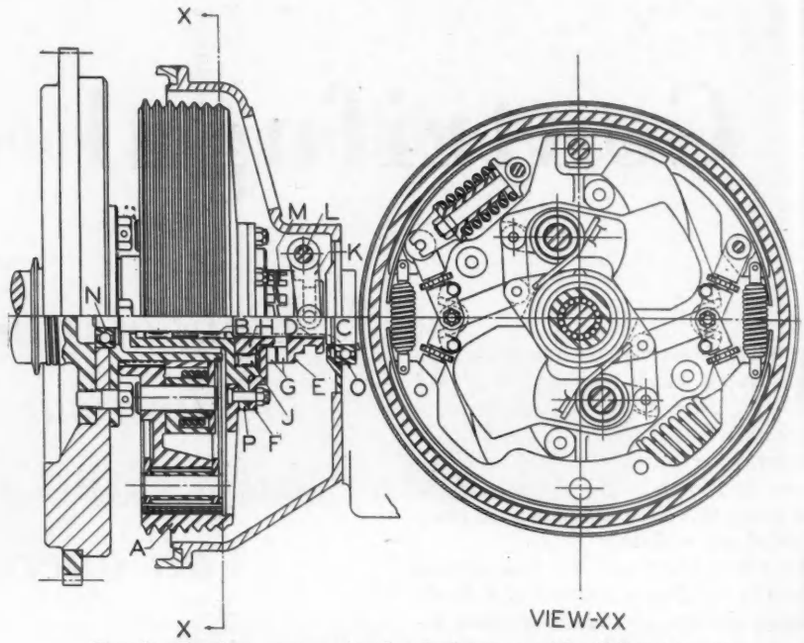


Fig. 2—Banker automatic clutch for use with sliding transmission

As shown in Fig. 2, clutch drum *A* is loosely mounted on roller bearings on clutch shaft *C*. The latter in turn is mounted in ball bearings *O,N* in the clutch housing, the same as with the conventional clutch. Shaft *C* has a splined portion *D* on which are mounted an over-running-clutch cam *H* and a sliding, cam-faced jaw clutch *E*. This roller clutch is so arranged that when jaw clutch *E* is disengaged from its mating member *F*, and the engine is then accelerated, drum *A* will drive shaft *C* through the roller clutch *H*. When the engine is decelerated, shaft *C* will rotate independently of drum *A*.

Jaw-clutch member *E* is controlled by yoke *K* on cross shaft *L*, which latter is hooked up to a pedal in the position of the usual clutch pedal but having only a small range of travel and requiring only a light pressure to operate it (10 to 15 lb.). It will be noted that cam surfaces *M* on jaws *G* are so shaped that they will not engage as long as *E* is rotating faster than *F*. This obviates all risk of damage to transmission members in the event the driver, through carelessness, allows the engine to slow down too far and then —releasing clutch *E*, which is coasting at vehicle speed—tries to pick up the engine. Owing to the presence of the roller clutch, member *F* can never run faster than *E*, so there is no risk of damage being caused by the driver speeding up the engine and releasing *E*.

When the vehicle is standing still, shaft *C* is at rest, even though clutch *E* may be engaged with *F*, so the driver can shift into whatever gear he wants to start in. Then, when the engine is accelerated, the vehicle starts and gains speed. When the driver wants to change to the next higher gear it is only necessary for him to press down on the clutch pedal and make the shift. While accelerating in this higher gear, he need not remove his foot from the clutch pedal, as the drive will be taken through the roller clutch *H*. It is even possible to start with the foot on the clutch pedal and keep it there while shifting through the various gears, but the foot should be taken off the pedal shortly after the high speed has been engaged; then, when the engine is accelerated, the jaw clutch will engage, affording a positive drive in both directions. In mountainous territory, if it is desired to use the engine as a brake, the same procedure can be followed.

The ease of shifting is due to the fact that when the jaw clutch is disengaged, the only parts rotating with the clutch shaft *C* are *E* and *H*, and these have very little inertia, owing to their small diameters. A vehicle equipped with this combination of a conventional transmission and the expanding type of centrifugal clutch has been in operation for nearly a year and is said to have given very good results. The combination is said to be particularly adapted for use on buses, trucks, tractors and military "tanks."

This Hamilton press in the Buick press shop is used for the first draw on the new front fender.

Production Lines

Ups Output

How much power does it take to drive a supercharger and what is the net gain in power through its application? That has been a moot question in supercharger debates. The answer was found in the paper presented by R. A. Plumb, experimental engineer, Graham-Paige Motors Corp., at the April meeting of Detroit Section, SAE. Said Mr. Plumb—"If the supercharger does nothing more than offset the loss of volumetric efficiency, the power required to drive it must have been developed through its use." In the case of a certain aircraft engine, the supercharger effected a net gain of 150 usable horsepower. Superchargers consume power at a rate which is proportional to speed and throttle opening but the power required to drive them is minute compared with the net gain for the engine. And that seems to be that!

Bright Nickel

We may have mentioned this before but it's well worth repetition. You will recall that Graham-Paige developed a unique system of pressure feed lubrication to the cylinder wall so as to assure adequate protection under all service conditions. Sometime after the 1937 line went into production, the company added still another feature. Now the compression ring on each piston has a hard coat of bright electroplated nickel to promote even better cylinder wall and ring life. Best evidence of the success of the Graham-Paige development is the fact that their engines enjoy freedom from scuffing and excellent preservation of crankcase oil.

Less Weight

According to the current issue of the *Aluminum News-Letter*, the power weight ratio of Diesel engines is being successfully increased by the use of aluminum alloys for many of the major elements. Among the parts now made of aluminum alloys are—cylinder heads, pistons, crankcases, cover plates, and fittings.

Shop Kink

Oxy-Acetylene Tips gives the following precautions to be taken in connection with gas welding equipment—

Unnecessarily long lengths of hose for welding and cutting apparatus should be avoided. When they must be used, care should be taken that the hose does not become kinked or tangled. Always protect hose from being trampled on or run over. The hose should also be protected from flying sparks, hot slag and hot objects and also from contact with oil or grease.

Resistance Welds

Ranking with the best technical literature we have had on our desk is the new handbook of Engineering Data on the theory and practice of resistance welding just issued by P. R. Mallory & Co., Inc. It's a handsome big book of 100 pages bound in cloth with board covers. Here for the first time the engineer and production man will find complete details on spot welding, seam welding, projection welding, butt and flash, electroforging, upsetting, etc. There is a section on materials to be welded and a final section concerned with the properties and applications of various Mallory alloys designed for welding. This book fills a much needed gap in the literature. We'll try to get you a copy if you want it.

Hard-Facing

Most production and maintenance men are familiar with the many useful applications of Stellite hard-facing in product, in tools, and for repairs. We recommend a reading of the feature article in the April issue of *Oxy-Acetylene Tips*, which gives in detail the best procedure for hard-facing-preparation, flame, deposit, finishing, etc. There may be something in it that will save time and money.

Chucks and Spindles

The benefits of a universal standard for chucks and spindle noses for various types of machine tools are set forth in a very comprehensive article by J. E. Lovely in *Industrial Standardization*, March, 1937. This refers to the new standard recently approved by the American Standards Association.

Labs Grow

A private survey indicates that there is a very considerable expansion program underway in many oil company laboratories. The problems of fuels and engine and chassis lubes are multiplying. And the old companies are doing their bit to anticipate the industry's requirements. —J. G.

Four-Door Locking Device

A FOUR-DOOR locking device, known as the Lok-All-Handle, has been made available to automobile manufacturers by the Houdaille-Hershey Corporation. Movement of a single central control handle on the right front door locks all four doors.

To lock all of the doors from the outside, two operations are necessary, viz., turning the key in the right front door and raising the outside right front handle. From the inside all doors can be locked simultaneously by merely raising the right inside front handle. The locks for the left front doors are provided with a tripping system which permits the operator to go back into the car through the door through which he alighted, if he inadvertently left the key in the dash. The rear-seat occupant, when getting in or out, can do the same as at present, if the car has been locked from the inside. To lock again from within when an occupant of the rear seat has alighted, it is only necessary to move the right front inside handle down and then up again.

It is possible to "free" the inside handles of both rear doors when locked from within to permit children to be locked in the rear seat, and still permit the front-seat occupant to get in and out from the left front door without fear of the children falling out or getting out.

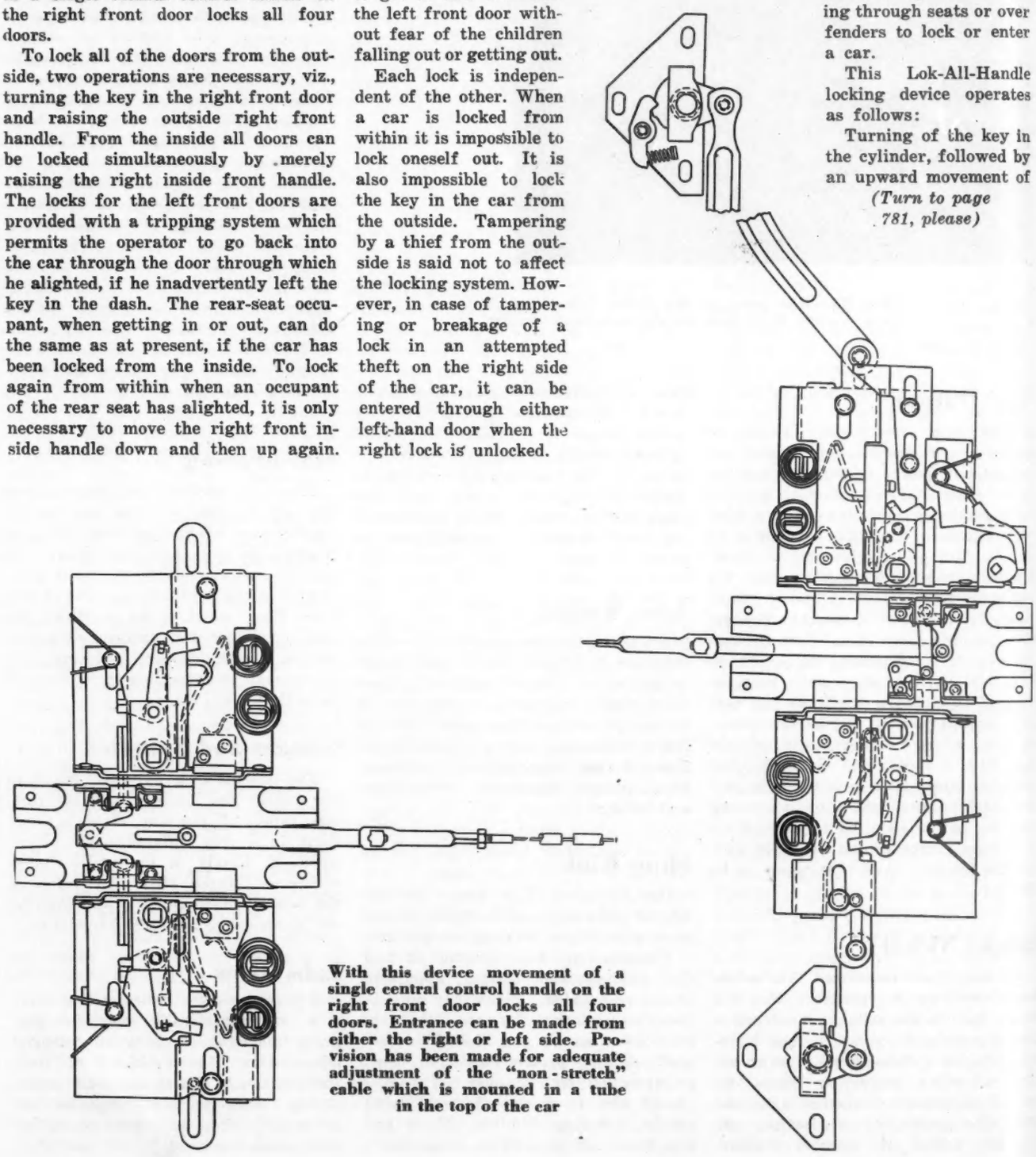
Each lock is independent of the other. When a car is locked from within it is impossible to lock oneself out. It is also impossible to lock the key in the car from the outside. Tampering by a thief from the outside is said not to affect the locking system. However, in case of tampering or breakage of a lock in an attempted theft on the right side of the car, it can be entered through either left-hand door when the right lock is unlocked.

When a car is parked in a parking space in such a way that insufficient room is left to enter from the right side, it is possible to enter from the left side. This makes unnecessary the crawling through seats or over fenders to lock or enter a car.

This Lok-All-Handle locking device operates as follows:

Turning of the key in the cylinder, followed by an upward movement of

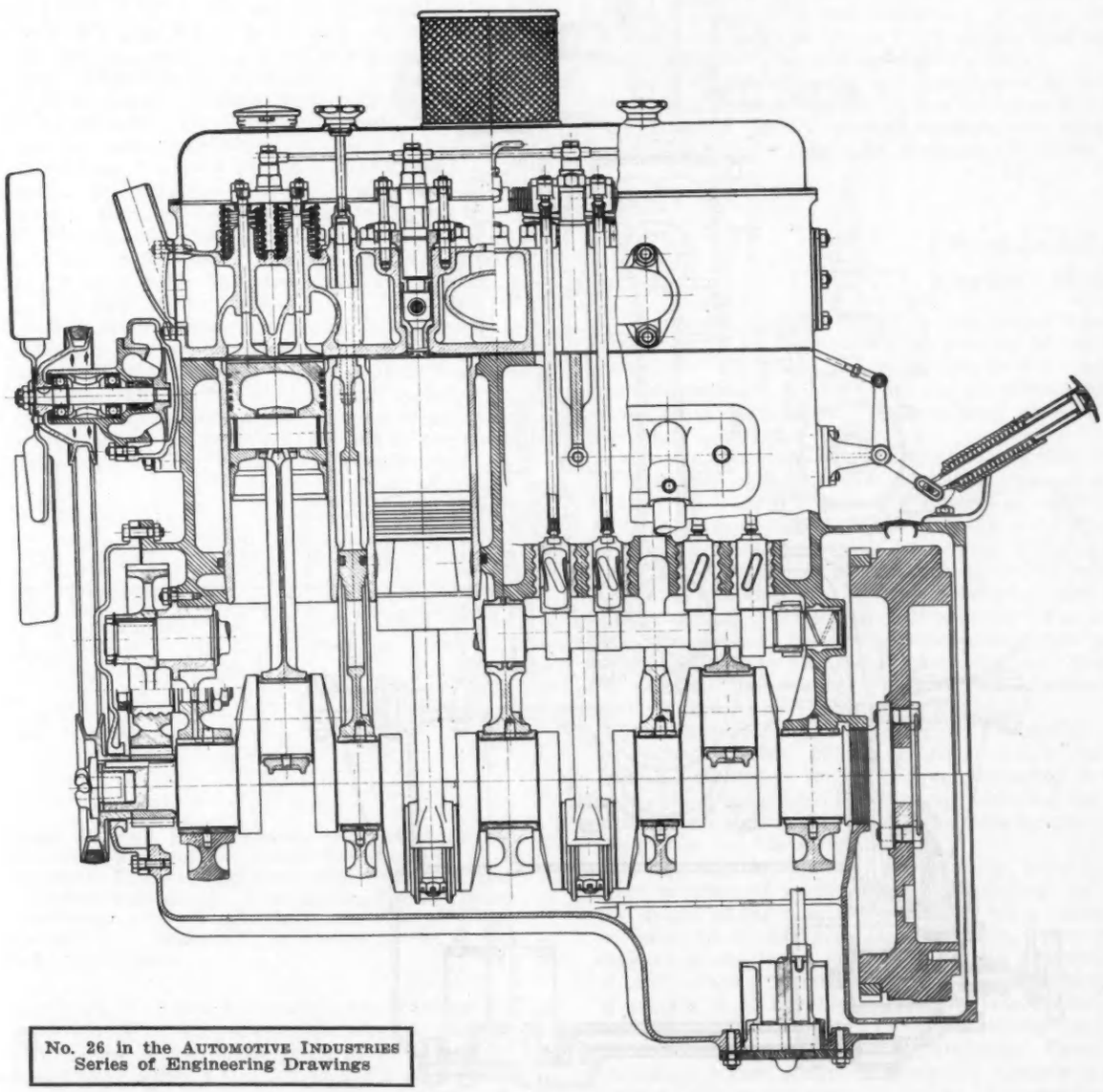
(Turn to page 781, please)



With this device movement of a single central control handle on the right front door locks all four doors. Entrance can be made from either the right or left side. Provision has been made for adequate adjustment of the "non-stretch" cable which is mounted in a tube in the top of the car

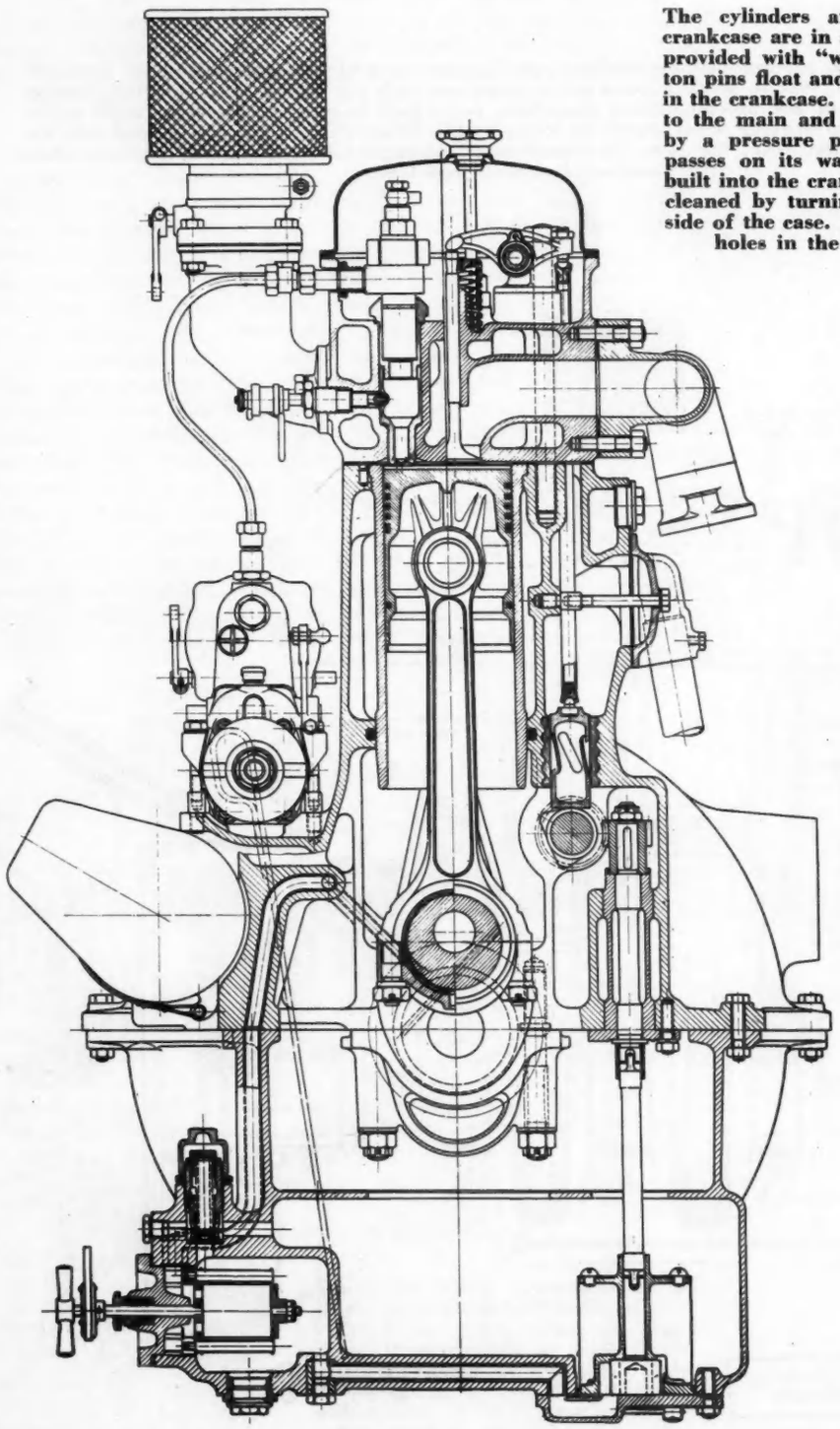
Buessing-N.A.G. Four-Cylinder 55-H.P. Diesel Engine

This engine is of the precombustion-chamber type, having precombustion chambers set vertically into the cylinder head, over to one side so as not to interfere with the valves. The injection nozzles are set into the top of the precombustion chambers, being held in place by the same studs as the latter. Starting in cold weather is facilitated by electric glow plugs whose filaments extend into the precombustion chambers from the side. The crankshaft is supported in five main bearings while the camshaft has three bearings.



No. 26 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

Buessing 55-H.P. Diesel Engine—Cross Section



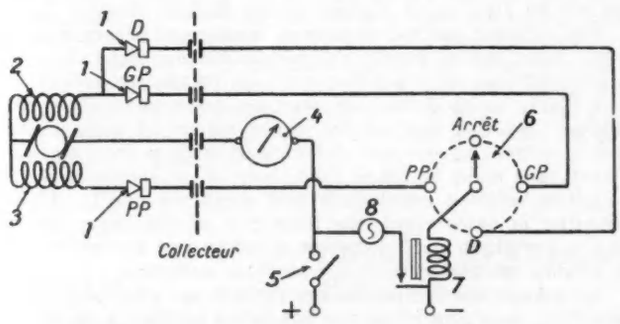
The cylinders and upper half of the crankcase are in a single casting which is provided with "wet" cylinder liners. Piston pins float and are lubricated by spray in the crankcase. Lubricating oil is forced to the main and connecting-rod bearings by a pressure pump in the sump and passes on its way through an oil filter built into the crankcase and which can be cleaned by turning a handle on the outside of the case. All oil passages are drill holes in the crankcase castings.

AUTOMOTIVE ABSTRACTS

Electrically-Controlled Variable-Pitch Propellers

THE principle of electric control of variable-pitch propellers may be briefly stated as follows: An electric motor located within the propeller hub turns the propeller blades around their common axis, through the intermediary of a gear train with large reduction ratio. In addition to this gear train the reduction mechanism comprises either a screw-and-nut mechanism acting on racks engaging with gear teeth cut on the roots of the blades, a screw-and-nut mechanism acting on links connecting to lever arms fixed to the roots of the blades, or worms meshing with the teeth of worm wheels cut on the roots of the blades. Electric current is led to the motor through collector rings and brushes, the rings being mounted eccentically on the propeller hub in back of the blades.

The parts mentioned in the foregoing constitute the movable portion of the system, associated with the propeller. The stationary part, mounted on the control board, comprises brushes equal in number to the collector rings. These control devices are connected by electric cables to the collector brushes on the propeller hub and to the source of electric current. Current is generally supplied by a 24-volt



Circuit diagram for electrically controlled variable-pitch propeller with automatic interrupters: 1, interrupters; 2, maximum-pitch field circuit; 3, minimum-pitch field circuit; 4, ammeter; 5, main switch; 6, reversing switch; 7, pilot-light relays; 8, pilot light; PP, minimum pitch; GP, maximum pitch; D, zero pitch; Arret, stop.

storage battery of 40-60 a-h. capacity, which is kept charged by a generator direct-driven from the aircraft engine. The motor by means of which the pitch of the blades is controlled may have either a single field and a single armature circuit, or two fields and one armature circuit. In the former case the adjusting motion is reversed by means of a double-pole switch which reverses the direction of current flow in either the field or the armature circuit. In the latter a single-pole switch sends the exciting current through either the forward- or the reverse-motion field winding.

To simplify the pitch-changing operation, a set of automatic interrupters may be added to the blade mechanism (see illustration). Interrupters with platinum-point contacts, connected in series in the armature circuit and which are opened and closed by the mechanism, will stop the motion of the blades at any given predetermined pitch. Thus the propeller may stop automatically in the small-pitch position (for getting off) and in the large pitch position (for cruising). Great precision is required in the installation of the interrupters, in order to assure adjustment accurate to within ¼ deg. The cams operating the interrupters are adjustable, so as to permit of varying the positions corresponding to minimum and maximum pitch.

Various details of design and installation, as well as the procedure in the operation of planes equipped with electrically controlled variable-pitch propellers, are explained in the article under review.—*La Technique Moderne.*

Front and Rear Engines Discussed

IN a paper devoted chiefly to rear-engined and front-drive cars, H. G. Röhr, technical director of the Daimler-Benz Co. of Stuttgart, Germany, discussed the advantages and disadvantages of both types and gave some information regarding the commercial development of each type in European countries.

Advantages of the rear-engined car are that it permits of combining engine, transmission and final-drive gear in a single unit; gives favorable conditions of visibility, owing to the forward location of the driver's seat; obviates annoyance of passengers from heat, noise and fumes; facilitates the development of streamlined bodies, and assures increased adhesion of the driving wheels. Owing to its better traction qualities, the rear-engined car is very popular with certain classes of customers, such as Swiss, Colonials, forestry officials, farmers, etc., and it is for this reason that the rear-engined car manufactured by the author's firm has secured a firm footing.

Disadvantages of the rear-engined car include the need for remote control of the gearbox, clutch and engine; greater difficulty of engine cooling, rendering it necessary to maintain air under pressure or providing an extensive piping system, and the necessity of heating the interior of the car by hot air in winter.

A rear-engined car will of necessity have a relatively large moment of inertia around its vertical axis, because the weight at the rear represented by the powerplant must be balanced by carrying the fuel tank, spare wheel and luggage at the front, in order to assure a suitable division of load between front and rear wheels. This large moment of inertia is of advantage from the standpoint of riding qualities, but detrimental from the standpoint of driving characteristics, especially at high speeds. There is a psychological reason against placing the driver's seat too far forward, as it engenders a feeling of insecurity. Owing to the comparatively limited market for this type of car, the need for remote control and the more complicated cooling system, a rear-drive car is somewhat more expensive

to produce than a conventional design. "Even though the design of the car has been most ingeniously thought out, the sale index figures have always been limited," said Mr. Röhr.

Advantages of front drive are that it permits of combining engine, transmission and final drive gear in a single unit, the same as the rear engine design; the mounting of the final-drive pinion is improved, and the final-drive gear is spring-supported; elimination of the propeller shaft below the body makes it possible to lower the floor without resorting to a tunnel for the propeller shaft; by using a compact engine and mounting the transmission in front of the axle the front seat can be located well forward, and by employing independent springing at the rear, almost all of the space back of the rear seats can be used for luggage, so that the space utilization is really excellent.

The principal disadvantage of front drive is the inadequate traction under conditions of steep grades and slippery road surfaces. When a loss of traction occurs, the usual remedy is to swing the front wheels around into an oblique direction and to rock the steering wheels from side to side until the car is under way. Alternately, the car may be allowed to roll back to a point where the front wheels can secure better traction. This emergency occurs rather infrequently, however, even in mountainous country, and, besides, anti-skid chains are easily applied to the driving wheels of a front-drive car.

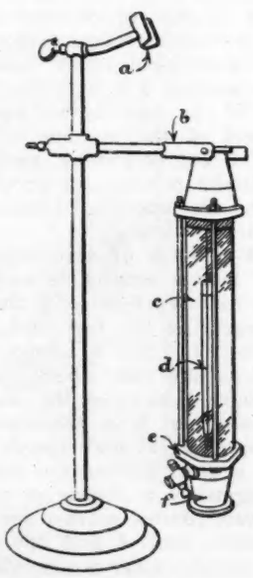
As regards cost of production, a front-drive car costs a few pounds less to produce than an equivalent rear-drive car with independently-sprung swinging axles; the constant-velocity universal joints it requires are available at reasonable prices.

In Germany the percentage of front-drive cars sold has increased from 1 to 23 in eight years. Front drive cars are being offered in France by Citroen and Rosengart and in Belgium by Imperia, and all of them have attained worthwhile sales figures.—*I.A.E. Journal* for November.

Viscosity Tests of Oils in Service

ALTHOUGH changes in the viscosity curve (viscosity vs. temperature) do not give complete information regarding an oil, it is a guide to the essential properties. Assuming that a new grade of oil is to be tried, its viscosity curve should first be plotted to ascertain whether it corresponds to that of the old oil or is better or worse. Small deviations naturally are not a reason for refusing to try the new oil. Alterations in the viscosity curve of the oil in use should be watched for. Oil which shows the least alteration with time should be adopted. When a system of oil control by viscosity is put into operation, it will frequently be found that oil has been considered too old or useless and changed too frequently, since with no means of testing the user is forced to discard oil without proper information about its condition.

The Steiner viscometer, developed by L. Steiner of Prague and recently introduced in England, is based on the principle that the time taken by an air bubble to rise through a graded tube containing the oil under test is a measure of its viscosity. The air bubble is of piston form and its length has no influence on its velocity. The tube (*d* in the drawing) is surrounded by a glycerine bath *c*, a thermometer clipped to the measuring tube being located in the bath. The complete assembly is carried by a pin joint from the bridle *b*. As shown in the drawing, the instrument is in position for measuring the time of rise of the bubble, but to heat the glycerine bath and bring the oil being tested to the desired temperature, it is swung into a horizontal position and heated by means of an electric hot plate, an alcohol lamp, or a Bunsen burner. To prevent loss of heat by conduction and to facilitate handling, the end flanges *e* of the bath are fitted with insulating end pieces *f*. After a measurement has been made, the bath and tube are inverted, the apparatus resting on support *a*, so the air bubble will travel to the lower end. The rate of rise of the bubble is measured by means of a stop watch.—*Engineering*.



Diagrammatic view of Steiner viscometer recently introduced in England

Measurement of Torsional Elasticity of Crankshafts

IN calculating the critical speeds of torsional vibration of engines, it is necessary to know accurately the masses rotating with the shaft and the elasticity of the crankshaft sections between these masses. The masses can be readily determined by weighing, but it is quite difficult to get at the torsional elasticity by calculation, especially if the crank arms are of irregular form, as is usually the case where the crankshafts are drop-forged and the arms are left unfinished. After the crankshaft has been machined up its torsional elasticity can be determined experimentally, and there are two methods that are applicable in this case, the static and the dynamic one. The relative advantages of these two methods and some of the points to be observed in order to obtain accurate results were discussed in a recent article by Dr.-Ing. J. Geiger of the M.A.N. firm.

The dynamic method is most advantageous where a heavy rigid mass can be rigidly secured to the driving end of the crankshaft, as in generator sets. Airplane propellers are not nearly so good for this purpose, because of their flexibility. By this method the exact values of some of the lower critical speeds are determined with a torsiongraph. Great care must be taken that there is no looseness in the coupling between crankshaft and armature shaft. If the coupling is quite rigid, the elasticity of the short section of the armature shaft between coupling and armature core is readily calculated with considerable accuracy.

All masses carried on the crankshaft are carefully determined by weighing or by the pendulum method. One reason for determining one of the lower and not the highest critical speed is that operation at the latter for any considerable time might injure the crankshaft, of which there is no danger in the lower critical speeds. Knowing the critical speed and the harmonic of the crankshaft torque to which it corresponds, the natural frequency of vibration of the crankshaft assembly can be determined, and from this, in conjunction with the moment of inertia of the masses on the crankshaft, the stiffness of the crankshaft as a whole and of a single crank throw can be calculated.

In determining the flexibility of the crankshaft statically, this should be done with the crankshaft in position in the engine. It is not necessary to apply the torque through a double-armed lever, as was often done in the past, provided the length of the simple lever is twenty or more times the diameter of the main bearing. This torque arm is secured

to the flywheel flange of the crankshaft. The forward end of the crankshaft is blocked by placing a ring between the piston and the cylinder head, of such width that the crank to which the piston is connected will be substantially in the 90-deg. position. In order that the pressure may be substantially uniform over the whole circumference of the piston, thick lead washers are placed between piston and ring or between ring and cylinder head. In the case of four-stroke valve-in-head engines these washers are cut away only at the valve heads. When such a torsional-elasticity test is made on an engine, the latter should be secured down to its base, so that the result will not be unduly influenced by the elasticity of the crankcase. The torsion moment is determined in several steps in both directions, with the aid of a suitable weighing scale, and the torsional deflections can be determined very accurately by means of mirrors. If the deflections for several different moments in both directions are plotted, it will be found that points obtained do not lie on a straight line but form a hysteresis loop, and a straight line should be drawn through this hysteresis loop which corresponds as closely as possible to the average inclination of the loop.—*ATZ*, June 10.

Oil-Burning Farm Tractor

SINGLE-CYLINDER oil-burning farm tractors have been available in Europe for quite a number of years, but have never come into use in this country. A tractor of this type, of 12-20 hp. rating, has been developed by Marshall Sons & Co., Ltd., of Gainborough, England. The engine operates on the two-stroke cycle, its bore being 6½ and its stroke 9 in. Crankcase precompression is used and the engine operates normally at 700 r.p.m. The crankshaft, which is 3¾ in. in diameter at the main bearings and 3½ in. at the crankpin, is supported in two double roller bearings. Engine frame and transmission and drive housing form the frame of the tractor. Injection pump and injection nozzle are of the C.A.V.-Bosch type, the cam of the injection pump being mounted directly on the crankshaft. The belt pulley, which contains the friction clutch, is mounted directly on the crankshaft. Starting of the engine from cold is said to be accomplished readily by one man in about one minute. A starting torch is employed which employs the usual fuel. Any type of crude or distilled fuel oil of the ordinary types is said to be suitable for the engine, except that the specific gravity must not exceed 0.90 and the closed flash point 190 deg. F. The total weight without operator is 4700 lb. There are three forward speeds, the maximum being 4¾ m.p.h. At this speed the tractor develops a drawbar pull of 950 lb. while in the two lower speeds the drawbar pulls are 1500 and 2300 lb. respectively.—*Engineering*.

Changes in German Patent Law

A NEW German patent law is in effect, and following are some of the points in which it differs from the old law:

Only the actual inventor or his legal successor is entitled to make application for patent. However, during the prosecution of an application the applicant is considered to be entitled to the patent, in order that the case may not be unduly delayed. Before instructions for the publication of the patent are given, the applicant must inform the Patent Office whether he is the inventor or the legal successor of the inventor, and in the latter case he must give the name of the inventor. The name of the inventor will be affixed to the patent and used in all publications concerning same. In case of an employed inventor, the works or the works manager is not the inventor, but the employe. This disposes of the concept of a "works invention" or "company invention." It had been hoped that the new law would deal specifically with the subject of inventions by employes, which has given rise to much ill feeling in the past. This it does not do.

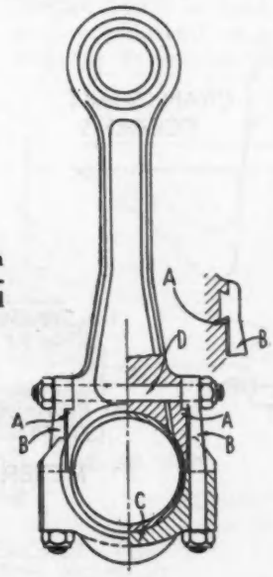
The novelty of an invention is impaired if it has been described in public prints during the past 100 years, or if its prior use in Germany is a subject of common knowledge. Publication during six months immediately preceding the application does not impair the applicant's claims if the description specifically refers to it as the work of the applicant or his legal predecessor.

Certain relief is granted applicants with respect to fees and dues if they can convince the Patent Office that these dues and fees would be a hardship in their particular case. Moreover, an inventor to whom a patent has been granted can have one-half of the annual dues remitted if he will notify the Patent Office in writing that he is willing to grant permission to use the patent to anybody willing to pay a reasonable royalty. This clause, relating to "willingness to license," was inserted to make it possible for the unattached inventor to keep his patent alive and to improve his chances of exploiting it profitably.

The German Society of Engineers for a long time had urged that judges in patent cases should be engineers. The new law does not meet this demand, but it makes provision enabling the judges to get the proper technical assistance. It is provided that copies of all documents in a patent suit shall be supplied to the president of the Patent Office, who may appoint a representative whom the judge may call in for consultation or who may be asked to attend the court sessions.—V.D.I.

A Connecting Rod Design of Swedish Origin

WITH increase in engine speeds it has become necessary to use crankshafts of increased rigidity, that is, with main and connecting-rod bearings of larger diameter. Connecting-rod big ends have finally become so big that it is impossible to withdraw them through the cylinder bore, which has made service operations more difficult. Various solutions of the problem that has thus arisen have been suggested, and one has been patented in England by the Aktiebolaget Atlas Diesel of Sweden. To keep down the maximum width of the big end and make it possible to withdraw it through the cylinder, the sides of the connecting rod head are planed and provided with slips *A* with which the bearing bolts *B* engage after passing through holes in the cap *C*. The bolts thus pass along the sides of the connecting rod end and not through the holes which are normally provided and they are held in position by a transverse bolt *D*. Other alternative constructions are also shown.—*The Automobile Engineer*.



Crankshaft design of the Aktiebolaget Atlas Diesel organization

Diesel Design, Fuel Research,

Testing Automotive Fuels for Octane Ratings

AN accurate spark-advance indicator is of considerable importance in connection with fuel tests for octane rating, as it has been shown that in certain engines this rating may change as much as 3½ numbers per degree of spark advance. Spark-timing devices are designed to give definite curves of advance and retard in accordance with engine speed and load, but their operation often is influenced by friction. A mechanism capable of indicating the ratio of the intervals between the passing of the spark and some other event in the engine cycle, to the remainder of the cycle, was described in a paper by J. R. MacGregor and K. R. Eldredge of the Standard Oil Co. of California. Connections to the engine are mainly of an electrical nature, so the installation is not difficult, and the instrument can be used for both road and laboratory tests.

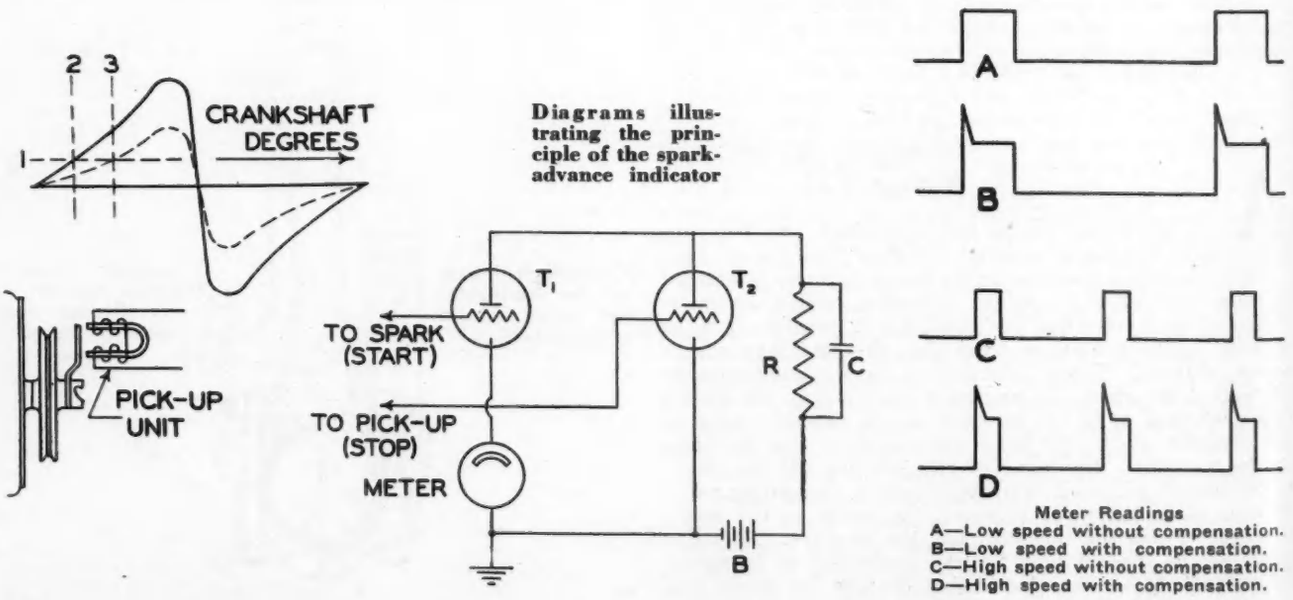
Two sources of repeating electrical impulses are provided. The high-tension side of the ignition system gives a starting impulse, while a pick-up energized by an element of magnetic material (a bolt head, for instance) rotating with the engine crankshaft furnishes the stopping impulse. A watchcase telephone receiver of the high-impedance type will serve well as the source of stopping impulses. Its principle of operation and voltage curve are shown in the illustration.

The impulse from the ignition system is applied to the grid of the thyratron tube T_1 and initiates the flow of plate current. This type of tube has the property of passing any current within its capacity with a constant voltage drop of approximately 15 volts. Once the plate current has started to flow, minor changes in grid voltage have no further effect. In order to stop the current it is necessary to drop the plate voltage across the tube to less than its ionization potential. Once ionization has ceased the plate voltage may be restored, but the tube will remain non-conducting until the grid is again charged positively.

Tube T_2 normally takes no current, but if its grid is made sufficiently positive by the impulse from the magnetic pick-up, the voltage drop across T_2 becomes less than the ionization potential of T_1 and the latter becomes non-conducting. The current which passes through tube T_1 and through the meter is determined by the voltage of battery B and the resistance F. Since it has been assumed that the first impulse comes from the spark and the second from a pick-up unit operated by the crank shaft while passing through top dead center, the interval of current flow corresponds to the spark advance. The meter reading varies with the time of current flow, that is, with the spark advance.

An energy-measuring device, such as a thermo-type meter, must be used. With an ordinary moving-coil meter, the indication is dependent on the wave form of the current impulse, and it also falls off as the rate of pulses increases. Increasing the speed from 500 to 3000 r.p.m. causes a drop of approximately 25 per cent in the meter reading; this error is too great to be tolerated, and compensation must be provided.

Two methods of compensation are available, the time method and the capacitor method, of which the latter seems to possess the balance of advantages. A capacitor connected in parallel with a resistor in the battery circuit is said to afford almost perfect compensation. Without the capacitor the current through the plate circuit rises almost instantaneously to the maximum value determined by the series resistor, and remains at that value until it is shut off by the stopping tube. With the capacitor in circuit, each time a current impulse is sent through the meter, an extra charge from the con-



Diagrams illustrating the principle of the spark-advance indicator

Lubrication, Engine Testing

are some of the subjects of papers presented at the S. A. E. Summer Meeting and abstracted here

denser accompanies it, the amount of the extra charge being proportional to the product of the capacitance and the voltage drop across the resistor *R*. The amount of charge furnished by the condenser per cycle is the same at all speeds, but in a given time the discharge from the condenser is greater at high speeds, and this greater condenser discharge increases the meter reading and is said to exactly compensate for the drop in current flow with increase in engine speed without the compensator.

Government Investigates Mica Spark Plugs

THE high specific output of military engines and the flexibility of operations required for the various manoeuvres necessitates the use of spark plugs which have a wide range of operation and which can withstand severe conditions for a reasonable length of time. For these reasons it has been found necessary for the service branches of the Government to conduct acceptance tests on the plugs of prospective contractors to insure that only the most reliable are supplied for general use. These tests determine the suitablity of the operating characteristics of the plugs and also detect any electrical, thermal or mechanical weaknesses which may exist as a result of unsuitable design materials or fabrication.

The aircraft-engine spark plug has become quite a problem, and a special investigation on mica-insulated plugs was made recently by the Bureau of Aeronautics. A paper dealing with this investigation and its results was presented by Melville F. Peters, H. Kendall King, and John P. Boston. The paper is too long and too mathematical to permit of abstracting in the usual way, but it may be stated that the investigation covered the following points: Temperatures, heat flow in and thermal expansion of the various elements of the plug, temperature of and heat flow in the high-tension cable; the spark plug shell, electrical characteristics of the plug, experimental designs and tests for determining the suitability of plugs for service conditions.

In the discussion, O. C. Rohde of the Champion Spark Plug Co. said he regretted the investigation had to do only with mica-insulated spark plugs. He was not in favor of mica-insulated plugs, for one reason, because suitable mica was not available in this country, the mica used for this purpose coming from India and from Madagascar. He therefore preferred to look for suitable substitutes for mica. He also deplored that there was no standard method of test for spark plug rating at present. Under the conditions, all the spark-plug manufacturer could do was make up a set of plugs and furnish them to the Government or to the engine manufacturers for tests. One of the chief problems confronting the spark-plug manufacturers, he said, was that of more suitable materials. Spark-plug manufacturers ordinarily would look to the metallurgists of the materials-producing industries for the development of these new materials, but it seemed they were so busy with materials of which larger quantities were required and the spark-plug manufacturers had to do their own materials research work. He said it was his opinion that a private research organization ordinarily could afford to devote about 20 per cent of its efforts to what might be called pure research, but during the past year his firm's research department had devoted about 40 per cent of its time to such work.

A Spark-Advance Indicator For Use on Road Tests

LABORATORY spark advance indicators, usually of the neon-tube variety, have been in general use for many years, but indication of spark advance under road conditions is a new development. With vacuum control of spark advance, the actual ignition timing in road operation cannot be predicted from laboratory data. For one thing, the effective vacuum

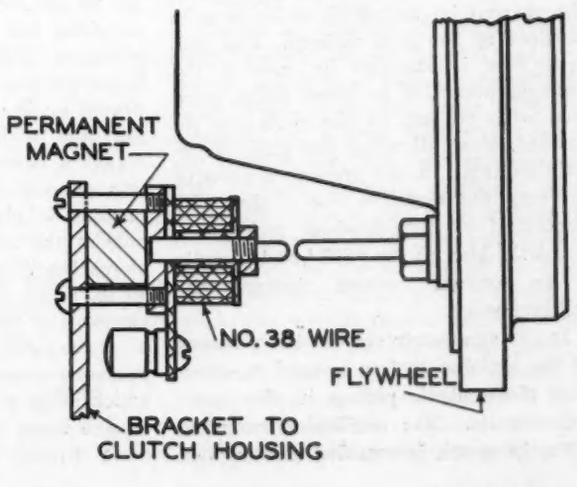


Fig. 1—Flywheel pickup for spark advance indicator

depends not only upon variable operating conditions, but also upon a delicate relationship between the carburetor throttle blade and the location of the vacuum take-off port, which in turn may be affected by slight deposits of dust or gum. Other disturbing influences include sticking of the governor or of the vacuum-advance mechanism, backlash in the driving gears, timing-chain whip, and error in the static setting of the distributor.

A spark-advance indicator for use in road tests was described by Sidney Oldberg, Gilbert Way, and J. B. Macauley of the Chrysler Corporation. Fundamentally, the system adopted is as follows: At a definite point of the cycle (60 deg. B.T.D.C.) a relay is tripped which instantly allows current to pass through a D.C. meter. The occurrence of the spark at some later point trips another relay which stops the passage of current, and the cycle is repeated *every* engine revolution. If the meter is damped, then the average value of current as indicated by the meter is to the maximum current which flows between the events, as the interval between the events is to 360 deg. Thus the meter indicates the angle between these events.

Tripping at the fixed point (60 deg. B.T.D.C.) is accomplished by an electromagnetic pickup working from a stud in the flywheel (Fig. 1). The stud rotates past the pole (1/16-in. gap) of a permanent magnet which carries a winding, thus closing a magnetic circuit which goes through the pole, bracket, engine, flywheel and stud. A voltage is thus induced in the coil which goes slowly positive and very rapidly negative as the centerline of the stud passes that of the pole piece, then drops to zero.

This voltage is amplified and applied to the grid of an RCA 885 gas triode (see Fig. 2). This tube has the property of passing no current from plate to cathode unless the grid bias is reduced below a certain value which depends on the plate voltage, but once the current is started its value is independent of the grid voltage. The current flow is stopped by raising the cathode potential to some value positive with respect to the plate for an instant, thus allowing the grid to regain control. In the present apparatus the amplified negative side of the pulse generated by the flywheel pickup reduces the bias on the "885" and permits it to conduct current through the milliammeter.

In the spark-trip circuit, the primary of the ignition system is used to eliminate electrostatic pickup in the internal circuits. The oscillation occuring with the spark is rectified and applied to the second "885," thus firing it simultaneously with the spark. This raises the cathode potential of the first "885" higher than its plate, thus cutting off the current flow through the meter circuit.

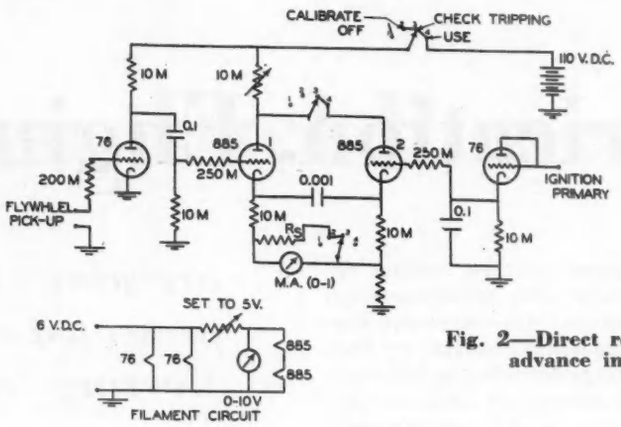


Fig. 2—Direct reading spark advance indicator

Report on Compression-Ignition Fuel Research

A REPORT on recent work of the Volunteer Group for Compression-Ignition Fuel Research was made by its chairman, T. B. Rendel of Shell Petroleum Corporation. During 1936 the Group more closely standardized details of both the delay-method and the critical-compression-ratio method of Diesel-fuel rating, and investigated a number of other methods, such as one originated by Socony-Vacuum Oil Company, using a balanced diaphragm instead of the bouncing pin, and the method due to Schweitzer and Hetzel of Penn State College, in which a magnetic pick-up is used. The latest test procedure for both the critical-compression ratio and the delay-period method of rating Diesel fuels are given in the report, which also contains the results of cooperative tests on a wide range of fuels made according to the latest procedures for both methods.

The Socony-Vacuum method is similar to the standard delay method but provides for the use of a balanced pressure diaphragm instead of the bouncing pin. An insulated contact is placed on the tip of the injector feeler pin and a slight rise of the valve makes a contact which starts an electric current flow. The pressure diaphragm is placed in the bouncing pin hole in the engine head. The pressure above the diaphragm is maintained at 50 lb. p. sq. in. above the compression pressure of the engine by connection to a carbon-dioxide bottle. Combustion pressure causes a contact to be made which stops the current flow. The successive times of current flow (ignition-delay times) are averaged by means of a condenser and voltmeter. Start of injection is indicated by a neon flash light and flywheel pointer which shows the injection time in degrees on a flywheel protractor for each cycle.

The Penn State method of ignition-delay measurement was described in AUTOMOTIVE INDUSTRIES of Aug. 17, 1935, page 203. Two modifications of this method involving direct machining have been devised, one by Mr. Ainsley of the Sinclair Refining Co., the other by Mr. Hubner of the Universal Oil Products Co., and both modifications were briefly described in the report.

Attention was called in the report to a new tentative standard test for ignition quality of Diesel fuels evolved by the (British) Institute of Petroleum Technologists. It provides for expressing ignition quality in "ignition numbers." The ignition number is the percentage of high-ignition-quality reference fuel in a mixture of high and low ignition quality reference fuels, divided by ten and rounded off to the nearest half number.

According to the report, the results of the past 18 months' work indicate fairly definitely that a direct matching method on the basis of ignition delay is the best from the point of view of reproducibility and validity, and warrants some sacrifice with respect to simplicity and speed of testing.

Considerable progress has been made in methods of instrumentation, and it was recommended that the bouncing-pin type of instrument should be definitely discarded in favor of the balanced-diaphragm or the magnetic-pick-up type. It was pointed out that further work in a larger number of lab-

oratories is desirable before definitely standardizing on this point. The cetane number will not be affected by whatever choice is eventually made, aside from the limit of error of the determination.

It was therefore recommended that Diesel fuels be rated for ignition quality on the basis of their cetane numbers as determined by an ignition-delay method on the high-turbulent diesel conversion of the C.F.R. engine, the type of instrument for recording the delay to be left to the choice of the user pending further work of the Group.

As part of the discussion of this report W. H. Hubner of Universal Oil Products Co. proposed a new calculated index of ignition quality, as an improvement on the "Diesel Index." This new index, to be known as the "Ignition Number," is equal to the product of the gravity, the aniline number, and the 50 per cent point, divided by 100,000 to give convenient figures. Ignition quality numbers calculated from test data for numerous Diesel fuels were plotted against their cetane numbers determined by the delay method, and the plot showed good correlation for all straight petroleum fuels but not for doped fuels.

Does Higher Oiliness of Lubricants Reduce Wear on Bearings?

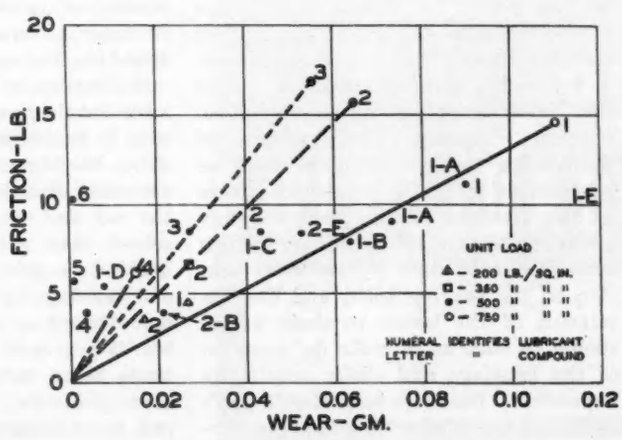
"OILINESS" in a lubricant naturally reduces the friction of a bearing supplied with it, because the very concept of oiliness is based on the observation that some lubricants, although showing the same viscosity as others in standard tests, result in lower friction under similar conditions of operation. The question then arises—Does the lubricant of higher oiliness also reduce the wear on the bearing surfaces? This problem has been attacked by the Standard Oil Company of California, and G. L. Neely of that organization described the apparatus used and some of the results obtained in that research. The testing machine used, known as a kinetic oiliness testing machine, has frictional elements consisting of two opposing surfaces, one in the form of a track having two flat-topped, sharp-edged concentric rails (hardened and ground steel), the other consisting of three phosphor-bronze buttons, each having a sharp outer edge. An important feature of the machine is that the surfaces are automatically maintained at a fairly uniform degree of smoothness by the lapping action produced by the combined rotating and sliding motion of the buttons.

In the tests, friction and wear values were obtained at a number of loads and speeds, using an oil temperature of 175 deg. F. The maximum dead load was approximately 750 lb. per sq. in.

It was found that both the frictional resistance and the wear vary directly with the load. Direct variation of friction with load (constant friction coefficient) is in accordance with Amonton's law for the friction between solid bodies (but contrary to the usually accepted law of fluid-film friction). The effect of speed seems to vary with the particular lubricant. With one lubricant the curve of rate of wear vs. velocity showed a pronounced peak while with another the rate increased uniformly as the speed decreased. The new concept of "coefficient of wear" was introduced. This is the quotient of the total wear (in a given time) by the load. The author called this a dimensionless quantity, evidently because both factors of the fraction may be expressed in weight units, but to this writer it appears that it is not dimensionless since the wear has the dimension of a mass (M) and the load the dimension of a force (MLT^{-2}).

Tests were made also on some lubricants with small proportions of (oiliness) addition agents, and the results were plotted in the form of friction vs. wear graphs. Referring to the accompanying graph, it will be seen that some of the addition agents (1-A and 1-B, for instance) reduced both friction and wear in the same proportion, while others (1-E and 2-E) while slightly reducing the friction, materially increased the wear. This, the author said, showed the futility of attempting to predict wear-reducing value from friction tests.

There was very extensive discussion on the two "oiliness" papers. One speaker said "oiliness" was defined as the property of a lubricant which reduces the friction under conditions of full-film lubrication, and this in itself excluded any relationship between oiliness and wear. Dr. Geniesse concurred in this view. He said it is easy enough to find addition agents that will reduce friction, but when you determine their effect on wear you get inconsistent results. The author of the paper in his concluding remarks said his organization did not use the term "oiliness" at all but, rather, "friction-reducing value."



Effect of addition agents on friction and wear

Kinetic oiliness testing machine Surfaces bronze on steel—Speed 3.6 ft. per min.—Temperature 175 deg. Fahr.

European Trends in Automotive Diesel Design

IN their paper "Recent Trends and Developments in European Automotive Diesel Engine Design," H. R. Ricardo and J. H. Pitchford gave a general review of the mechanical construction of these engines and some notes on the most persistent troubles together with the remedies therefor.

The use of separate aluminum crankcases has been largely discontinued, one reason being that lack of rigidity of these light crankcases was held responsible for a good deal of the bearing trouble that has been experienced. The authors claimed, moreover, that with competent design it is possible to bring the weight of a one-piece iron block down as low as that of the composite construction. For road-vehicle work, the weight of the engine, inclusive of the flywheel but without generator and starter, should not exceed 10 lb. per hp., for displacements of 100-600 cu. in. With a crankcase of really rigid design and provisions to keep the

temperature of the lubricating oil below 200 deg. F., main bearing troubles have practically disappeared, and babbitt bearings have come back in a number of instances.

For four-cylinder engines of up to 150 cu. in. displacement, a three-bearing crankshaft is adequate, although there is a certain sacrifice in smoothness unless the end walls of the case are made very stiff. In the case of the six-cylinder engine, the seven-bearing crankshaft is preferable, because it allows of the use of a wide center bearing and eliminates the need for a fully counter-weighted crankshaft, which is so undesirable from the torsional-vibration standpoint. At the crankshaft level the crankcase should be made as wide as possible, to eliminate longitudinal "wriggle."

Recently there has been a decided swing toward the dry liner, because it gives less trouble from distortion and eliminates troublesome gas and water joints. The dry-liner construction is probably somewhat more expensive and also slightly heavier than that embodying a wet liner. As regards liner wear, that depends more on the conditions of use of the engine than on the material of the liner. If the engine is operated a good deal of the time at temperatures which are below the dew point of the acid products of combustion, the wear is likely to be rapid, although the greater the resistance of the material to corrosion the better chance it will have. The critical temperature at which this corrosive action begins is 160 deg. F., and thermostats can be used to advantage to maintain the temperature above this point.

Aluminum-alloy pistons are almost universally used, and in some cases where trouble has been experienced from excessive ring-groove wear, these are provided with ring carriers of iron, in which the grooves for one or two rings are turned. Piston-ring sticking has not proven as serious a problem in Europe as it appears to have been in this country. The causes of this trouble were discussed by the authors in considerable detail. One cause is "dirty combustion," which includes both combustion resulting in a smoky exhaust at the full-load end of the range, and misfiring at the idling end, and the authors maintained that with recent improvements in combustion-chamber design there is no excuse for a smoky exhaust either when idling or when under full load. Another cause is high temperatures of the pistons and rings, and to keep down these temperatures it is absolutely essential that the rings should provide a good seal from the very beginning. Care must be taken not to permanently distort the rings during assembly; distortion of the cylinder liner is equally harmful, and in this connection it is noteworthy that the practice of finishing the bore after the head has been put in place is gaining ground. This eliminates irregularities in the bore due to drawing up of cylinder-head nuts. An increase in the number and a decrease in the size of cylinder-head studs is helpful in this connection. As a further precaution against excessive piston and ring temperatures, the water jacket should be extended below the lowest point reached by the ring pack, as the rings are practically stationary when near the bottom end of their travel and therefore have a chance to give up considerable heat if that part of the barrel with which they contact at that time is surrounded by water.

Ring Clearance

Ring sticking seems to be at its worst for a certain rate of oil consumption; if the consumption either exceeds or falls below this critical rate the trouble is alleviated. To assure effective oil control, the oil ring should have a minimum up-and-down clearance. While it is possible to reduce the amount of oil passing the piston below the safe limit, there is a wide margin between the minimum safe rate of oil consumption and the one that gives most trouble from ring sticking.

A number of automotive oil-engine manufacturers have taken a leaf from the book of aircraft-engine manufacturers by placing rings with tapering section in the two upper grooves. In the author's experience, this has proved a complete cure for ring sticking in every instance where it has been properly applied.

The chief other source of trouble encountered in the development of the high-speed Diesel engine has been "shattering," which occurs almost invariably in the lower half of the main, and the upper half of connecting-rod bearings. No very definite explanation of this trouble can be given, but one or two points in design which have proved essential to success may be set out. All bearing shells (bushings) must be set in the housings so as to reduce the deformation under load to an absolute minimum. The thickness of the bearing shell should be as small as possible, as this will reduce the stress in the material of the shell for any given deformation of the support. Much damage can be done by excessive tension on the bearing bolts, and the size relation of the latter to their bosses should be such as to make deformation of the housings and shells practically impossible. Bearings bolts should preferably be provided with a hexagon corresponding to the next smaller diameter.

The resistance to fatigue of babbitt bearings is enormously reduced by allowing them to reach excessive temperatures. Provided they are well fitted in their housings, the main bearings are incomparably better situated in this respect than the big-end bearings, as the entire engine block serves as a heat reservoir and radiator for the former. The big ends, on the other hand, are entirely dependent on oil circulation for the dispersion of the heat generated in them. It is therefore necessary to provide the most rapid circulation of oil through these bearings that is consistent with reasonable oil consumption, and to keep the oil as cool as possible. In one type of engine illustrated in the paper (six-cylinder 4¾ by 5½ in.) provided with a conventional lubricating system, the rate of circulation at full load is 1½ gal. per b.hp. per hr. This should always keep the oil temperature down to 180 deg., and the temperature of the oil film in the bearing to a little over 220 deg.

Lead-bronze and cadmium-silver bearings permit of much higher oil temperatures, but they require clearances about 40 per cent greater, and this aggravates the oil-consumption problem; they also necessitate hardened crankshafts, which are expensive and sometimes treacherous. The authors said they had been most favorably impressed by the exemplary behavior of Satco bearing metal, notably in the bearings of an experimental 6 by 6.6-in. engine running at 2500 r.p.m. and carrying a load corresponding to 160-170 lb. per. sq. in. b.m.e.p., giving a big-end loading of the order of 3500 lb. per sq. in. This is a high-lead alloy and does not call for a hardened shaft.

Bearings

Stress concentrations in journals should be avoided, and oil holes in a crankshaft should be drilled obliquely, instead of parallel to the crank arms, in order to avoid such concentrations. Breaking the upper surface of the big-end bearing in order to provide pressure lubrication to the small end is also to be discouraged. There is a tendency for big-end bearing loads to concentrate directly under the shank of the rod, and one manufacturer recently solved this problem and more than doubled the life of his white-metal big-end bearings by drilling a 12 per cent hole (based on cylinder bore) through his 48-per cent big-end. The hole extends clear through the most robust part of the rod, parallel to the crank-pin, immediately above the arch of the

big end, and provides a sort of cushion for what is ordinarily the most heavily loaded part of the bearing. Some manufacturers seek to combine the load-carrying capacity of lead bronze with the dirt-accommodating properties of babbitt by using lead bronze in the top half, babbitt in the cap of the big end, the other way around in the main bearings.

Crankshaft dimensions of modern engines are determined primarily by the consideration that torsional vibration under the influence of the sixth harmonic should occur at a speed outside the running range of the engine as determined by the governor. The authors reviewed briefly the measures resorted to with a view to raising the natural frequency of the crankshaft. The shaft must be short and stiff, which means that cylinder center distances must be made as small as possible consistent with adequate bearing area and valve area; crank arms should preferably be made of oval form, which permits of making them quite narrow; counterweighting must be reduced to the absolute minimum consistent with the bearing area and the general stiffness of the crankcase. In a six-cylinder engine in which balance weights cannot be dispensed with entirely, satisfactory results may be obtained by restricting them to the inner arms of the two center throws and of Nos. 1 and 6 throws, at 120 deg. to the arms.

Even when everything possible in this direction is done, it is difficult to push the natural frequency of torsional vibration of a 500-cu. in. engine above 12,000 cycles per min., so that the critical speed corresponding to the sixth harmonic comes at 2000 r.p.m., which is uncomfortably near the useful maximum speed. With a decrease in engine size the picture brightens, and with a 300-cu. in. engine there is no difficulty in raising the natural frequency of the crankshaft assembly to 18,000 cycles per min., which makes the sixth-harmonic critical speed 3000 r.p.m.—well above the speed at which such an engine would be governed. In larger sizes the 4½ harmonic is apt to give trouble, but much of its sting can be removed by a change in the firing order. Torsion dampers are useful as long as they don't seize, but if they do without the operator recognizing the trouble, they can make conditions infinitely worse.

Great strides have been made recently in controlling the temperatures of the cylinder-head wall exposed to the combustion temperature, by discharging the cooling water entering the head (by distributor pipes or cored passages) directly against the high-temperature zones. This prevents the formation of hot pockets and steam bubbles, and so minimizes the deposition of scale. At full speed the rate of circulation should not be less than 15 gals. per hp. per hr. These measures have not only eliminated cracking of cylinder heads, but also done away with many obstinate cases of valve-seat distortion.

A small but important point is that all injector holes in cylinder-head castings must be bored on both diameters and faced for the gasket at the same operation.

Four-Door Locking Device

(Continued from page 770)

the right front outside handle, throws out a pin in the right front door lock and at the same time moves the retractor bar in the lock out of engagement with the latch bolt. This pin moves against a tablet in the center door pillar. Back of that tablet is a powerful toggle or cam which is moved downward or in a pulling direction. At one end of that cam in the door pillar is attached a "non-stretch" cable which

43 to 1
43 to 1 - a somewhat mysterious headline perhaps, but one which, nevertheless, emphasizes an important point. This ratio represents the results of a test in which a journal of 2 in. diameter was run in a white metal bushing at 500 r. p. m. and 230 lbs. per sq. in. load. Oil was fed to the assembly until stable conditions of lubrication were obtained. The supply was then cut off and the bearing seized in 36 minutes. The experiment was repeated, but this time oil containing "dag" colloidal graphite was used. The journal ran for over 26 hours before tightening in the bearing was noted. This test indicates that graphoid surfaces, possessing low friction properties, will, for surprisingly long periods, safeguard against metal-to-metal contact during breaks in the lubricating film. Write for copy of Booklet 600 describing "dag" colloidal graphite.
Ask your oil supplier about his colloidal-graphited oils today
ACHESON COLLOIDS CORPORATION
PORT HURON MICHIGAN
dag
COLLOIDAL PRODUCTS
COLLOIDAL GRAPHITE
"DAG" COLLOIDAL GRAPHITE IS A 100% AMERICAN MADE MATERIAL
ACHESON COLLOIDS CORP., PORT HURON, MICH.
Please send gratis, story on "dag" Colloidal Graphite and copy of "cigarette paper" test.
NAME .....
ADDRESS .....

is mounted in a tube in the top of the car. This cable is attached to a set of toggles or cams in the center door pillar on the opposite side of the car. The pulling motion on the cable forces these cams against two similar sleeves on the left side of the car, which in turn forces a pin in each lock, which moves the retractor bar in each lock away from the door latch, thereby insuring locking of the doors on the left side of the car.

Simultaneously with the movement of the pin, the master lock, a sleeve is pushed backward in the right post assembly; that sleeve forces a tablet against the pin in the right rear door, causing the same locking movement in the lock as on the left side of the car. This completes a positive locking action and permits all outside handles to be "free."

To unlock the doors it is only necessary to turn the key in the master door. Locking all of the doors from a single control point from the inside of the car is completed by the upward movement of the inside right front door handle. The action is the same as when locked from the outside of the car.

Provision has been made for an adequate adjustment on the cable for use in production or service in the field.

Stuttgart Museum Shows Automotive Progress

(Continued from page 765)

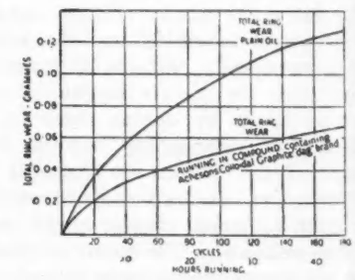
In the above the terms, Daimler and Mercedes have been used indifferently. In reality there is no Mercedes company, the pioneer German firm being the Daimler Motoren Gesselschaft. But when Herr Jellineck secured the selling rights for these cars, he decided to give them the name of his daughter, "Mercedes," and was so successful in this that the official name Daimler was forgotten. Later Jellineck added Mercedes to his own name, making it Jellineck-Mercedes. Probably this is the only case on record of a father being named after his daughter.

Effect of Colloidal Graphite

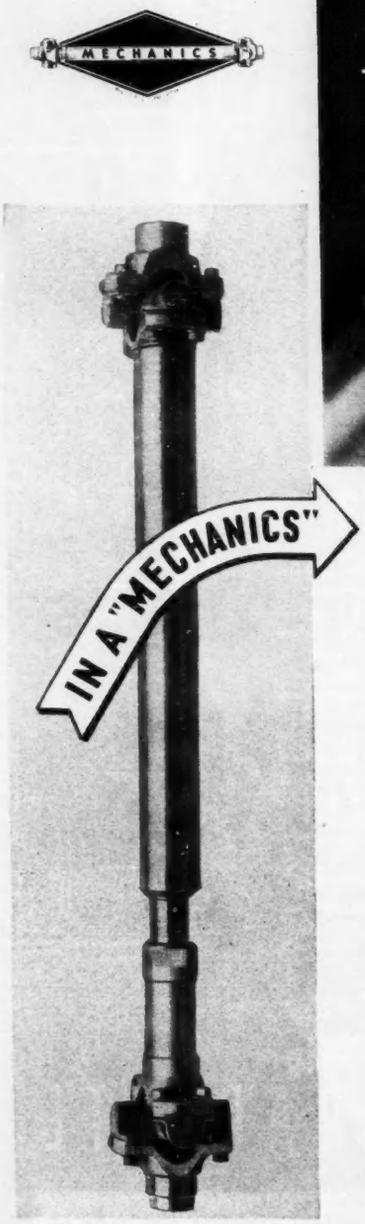
(Continued from page 766)

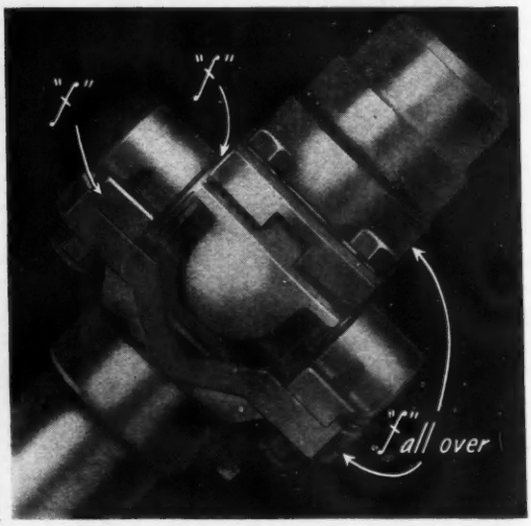
cold running. Following is an official summary of the test:

"A sample of running-in compound containing 'Acheson's' colloidal graphite—'dag' Brand—was submitted on April 4th, 1935, for test purposes with respect to its effect on cylinder and piston-ring wear in a new engine during the running-in period. Comparative tests were carried out on a plain oil and on oils containing proportions of running-in compound recommended by E. G. Acheson, Ltd. An unused cylinder barrel and unused piston ring were used in testing each lubricant and the test procedure involved repeated starts from cold, so that a certain amount of cylinder corosion probably occurred. The results show that during the running-in period the wear with oil containing colloidal graphite was approximately half that observed with plain oil."



Ring wear in relation to time. The upper curve shows the total ring wear with plain oil; the lower that with a running-in compound containing Acheson's colloidal graphite





More "f" Means Better Balance

Better balance in a universal joint means smoother running, longer life. Perfect balance calls for uniform distribution of weight around the center of rotation. This can be obtained only when the small irregularities which exist even in the best of forgings are removed by machining. Consequently all parts in Mechanics Universal Joints having any appreciable effect on balance are *finished all over* or machined from specially rolled sections. Carefully planned manufacturing and assembling is double-checked by searching inspections and tests. The finished product must closely approximate perfect balance before it can leave our plant, and it runs smoothly when installed. Other distinctive features of design and manufacture insure reliable operation and long life. As a result, Mechanics Universal Joints and Shaft Assemblies meet the most rigid service requirements; are used in leading cars, trucks, and busses as original equipment and by many service stations and fleet owners for replacements. Investigate.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

Air Compressors

Four and Six Cylinder Units Offered by Schramm

A new line of air compressors especially designed for installation in industrial plants has been announced by Schramm, Inc., West Chester, Pa. The units are of vertical, cylinder-in-line construction with water jackets surrounding the entire cylinder area.

The "Utility" units are arranged for either vee-belt drive or for direct coupling with electric motor.

Sizes are offered with air deliveries of 85, 105, 160, 210, 315 and 420 cu. ft. actual air delivery per minute. Horsepower capacities range from 20 to 100 hp.

Spot Welder

Upper Electrode On New Machine Moves In Vertical Plane

A new type spot welder with a number of unusual features has been developed by the Taylor Hall Welding Corp., Worcester, Mass.

The unit is arranged so that movement of the upper electrode is in a vertical plane and not on the arc of a circle. Transformer and upper horn assembly are used as the pressure unit with an adjustable counter weight for light and medium heavy work. Foot treadle leverage is 3½ to 1.

A new design of rocking step plate located on the end of the treadle operates the switch. According to the manufacturer this arrangement eliminates 50 to 75 per cent of the usual foot movement and allows operations which are 30 to 50 per cent faster as compared with conventional type equipment.

Other features include: a turnbuckle adjustment for foot treadle height so that when flat stock without flanges is being welded movement of the upper electrode is sufficient to release the work; welds are made as the foot is raised and the maker claims that this eliminates pounding at high speeds.

Milling Machines

"Standard" and "Dual Control" Types Developed by Brown & Sharpe

Eight newly-designed plain and universal milling machines were recently announced by Brown & Sharpe Mfg. Co., Providence, R. I. The machines are available in two styles: the Standard type and the Dual Control type. Both are high-speed units, with 16 spindle speeds ranging from 30 to 1200 r.p.m. Equipment can be arranged for either overhead or direct motor drive.

Features are listed by the manufacturer as: travel, 140 in. per min. longitudinal, and 56 in. per min. transverse and vertical; safety handcrank for longitudinal adjustments of the table; automatic lubrication of knee and column mechanisms; and rotating speed and feed rate selective levers. All eight machines have two-position control of feed engagement, of the direction of all feeds, and of starting and stopping the machine.

Dual Control type machines have dual controls for all fast travel movements and hand adjustments, providing complete control from front and rear operating positions. Units of this type have 32 rates of feed, from 9/32 in. to 40¼ in. per min. longitudinally and ⅛ in. to 16⅛ in. per min. for transverse and vertical feeds.

Standard type milling machines have 16 feed rates, 11/16 in. to 26 in. per min. longitudinal and 9/32 in. to 10⅜ in. per min. transverse and vertical. A wide feed range mechanism, giving 32 feed rates of the same range as on the Dual Control type, is available as an extra for Standard type equipment.

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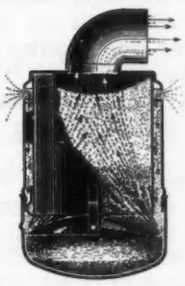

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This type thrives on dust. Even excessive dirt accumulations in its settling cup leave its cleaning power unchanged. When dust clouds hide the sun, an engine protected by this cleaner still develops its full rated power after months of use; long after less guarded motors have been rebored, then junked.

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AIR CLEANERS

Rear-Engine Bus Tested in British Long-Distance Service

THE first British rear-engined bus to be put into service is the product of one of the biggest operators in England, the Birmingham & Midland Motor Omnibus Co., and was designed by its chief engineer, L. G. Wyndham-Shire. Only two have been built so far; one has covered approximately 50,000 miles in a local service at Birmingham, while the second is operating between Birmingham and London. This long-distance bus has a 32-seated luxury body of restrained streamline design, with large accommodation for luggage on the sides of as well as above the engine.

Like all Midland red buses, the new type has been built throughout at the company's own plant. The engine, a six-cylinder type with 4 by 5-in. cylinders, is arranged transversely on the left of the center line and drives through a Daimler fluid flywheel and thence through bevel gearing and a transmission line leading forward at an angle of 78 deg. to a four-speed Cotal electro-magnetic gearset, a short (18 in.) propeller shaft and overhead worm gear at the center of the rear axle. The maximum angularity of the propeller shaft joints is only about 10 deg. The worm gear gives a reduction of 6.4 to 1, but with the bevel gear the over-all ratio in high is 6.07 to 1.

There are two radiators, one on each side, each with its own fan. One draws air in through the left-hand radiator and the other expels it through the right-hand one. The radiators are enclosed by detachable wire screens, while four large detachable rear panels give direct access to the valves, carburetor, oil filler, and other "accessories," which are all on the rear side of the engine.

The power unit is bolted to dropped extensions of the side rails of the chassis. The rearmost cross member is removable, as is the framing of the four rear panels, and when these units are taken away the power unit can be removed bodily.

There are only two pedals for the driver, brake and accelerator, gear-shifting being done by a switch lever under the steering wheel. Connection between the accelerator pedal and throttle is by a Lockheed hydraulic equipment. Two engine-starter buttons are provided, one in front of the driver, the other adjacent to the engine. Service brakes are Lockheed hydraulic, while the hand lever operates the rear brakes only by mechanical means.

A spare wheel locker is built into the front of the body, below the driver, with provision whereby the hand-brace for the stud-fixing nuts can be used as a crank to operate a winch for raising or lowering the wheel from or into the locker.

It is not intended to manufacture the bus for the market.

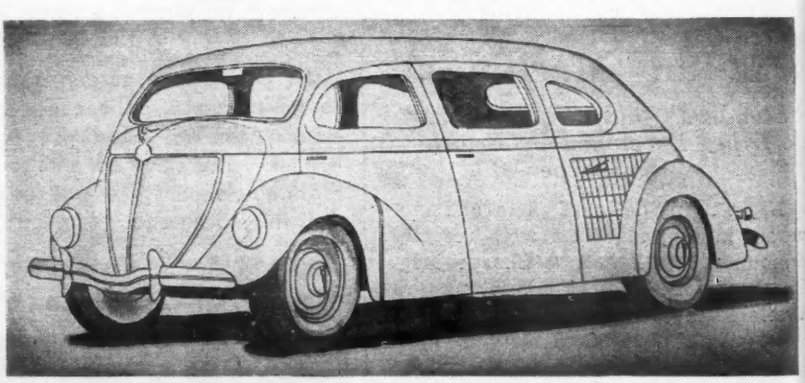
The height of the chassis with the bus fully loaded is 27 in. above ground level and with 74 in. headroom, the over-all height of the bus is 108 in. The wheelbase is 15 ft. 7 in. and the turning circle, 63 ft. diameter. The maximum speed of 55 m.p.h., in high, represents nearly twice the English legal limit of buses, i. e., 30 m.p.h. in town and country.

As in the case of all other Midland red buses, there is no intention on the part of the company to manufacture for sale.

Sedan Body "Stretched" for Engine in Rear

REFERRING to the article "Rear Engines at Low Risk," in the Nov. 28 issue of AUTOMOTIVE INDUSTRIES, Arnold Brooks of Whitman, Mass., sends us drawings of a rear-engined car which he prepared about a year ago. He used a Ford 1935 four-door model and with the aid of tracing paper proceeded to "stretch" the body and put the driver in front where his vision would be improved, and the engine in the rear "out of the way," without changing the conventional appearance materially. The drawing reproduced herewith was made from a later tracing in which the appearance of the 1936 Ford was simulated.

The dummy grille is retained for "psychological" reasons and the space behind it is used to store the spare tire and luggage. The engine, a Ford V-8, is mounted transversely in front of the rear axle, but Mr. Brooks thinks an in-line engine would meet the requirements better. The radiator is of the cross flow type and is in two sections, the water passing through the top section in one direction and through the lower section in the reverse direction. The water pump is of the same type as used on Ford and Zephyr cars, delivering into the jacket of the block. Engine and transmission may be removed as a unit for major repairs or replacement, being dropped to the floor. The drive from the transmission is through a short shaft with two constant-velocity universals. Final-drive gears are of the herringbone type.



Drawing of the Brooks rear-engine body

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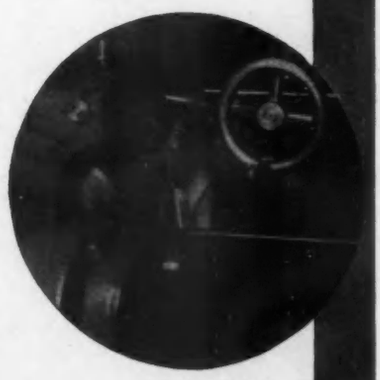

Operation: Finished Grind Large Diameters
Machine: No. 2 Cincinnati Centerless Grinder
Material: Cold Rolled Steel
Spindle Speed: 1150 R.P.M.
Coolant: 1 part Sunoco to 40 parts Water

Operation: Grinding Piston Pins
Machine: No. 2 Cincinnati Centerless Grinder
Material: Hardened Steel
Production: 28 per minute
Coolant: 1 part Sunoco—40 parts Water

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Coolant Dictates Design

(Continued from page 756)

reduction gear (for the propeller) is splined to the front end of the crankshaft, and a spur gear splined to the rear end drives the oil pump, coolant pump, fuel pump, vacum pump, and generator. The engine starter also operates through this gear. The engine is equipped with a friction damper at the front, and with a dynamic torsional balancer at the rear end, and these devices are claimed to enable it to run at far above its rated speed without injurious vibration.

The reduction gear consists of an internal gear meshing with a pinion splined to the crankshaft, the gear being bolted to an integral flange on the propeller shaft. A large, single-piece, steel-back, bronze bearing completely encircles the outer diameter of the internal gear. This reduction gear is enclosed in a single-piece aluminum-alloy housing which forms the nose of the engine. It pilots into and is stud-fastened to the upper and lower crankcase assembly.

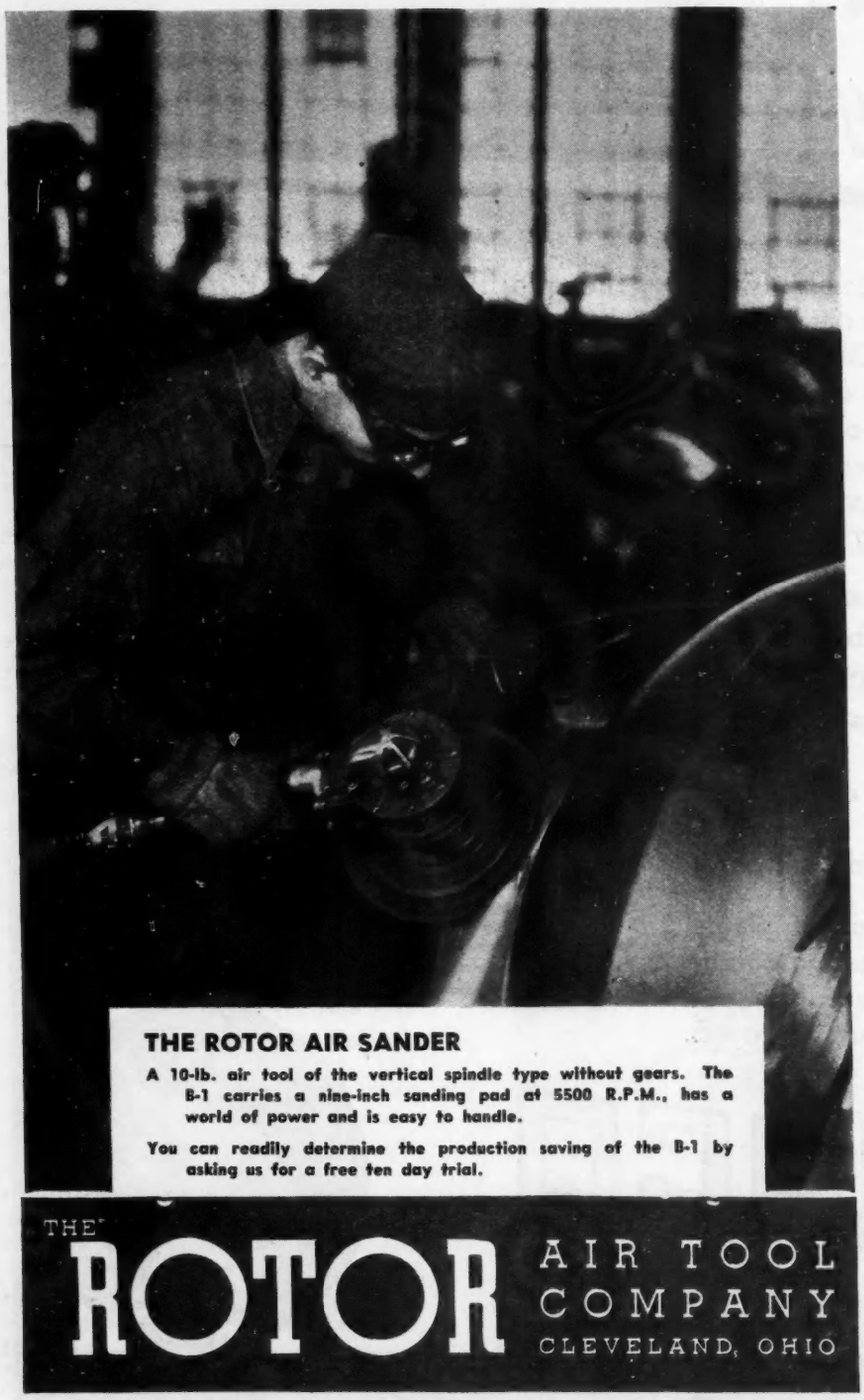
The propeller-shaft assembly located in the reduction-gear housing consists of two concentric tubular shafts, of which the inner one transmits the engine power, while the outer one takes care of bending stresses due to the propeller. Pistons are machined from aluminum-alloy forgings, with the underside of the heads grid-ribbed to facilitate cooling. Connecting rods are of the fork and blade type, machined and polished all over. Two rods are mounted on each crankpin, with a single, split, steel-back bearing, faced with lead-bronze on the inside for the crankpin bearing and on the outside for the blade-rod bearing.

The necessary housing is mounted directly on the rear of the crankcase; it is a magnesium-alloy casting and contains the centrifugal supercharger and the drives for the coolant pump and camshafts, fuel pump, vacuum pump, oil pump and generator. The impeller of the supercharger has a diameter of 9½ in. and is driven at 6.75 times crankshaft speed. To increase the efficiency of the supercharger, it is provided with six curved vanes in the diffuser passage. Its impeller shaft is supported in two steel back, lead-bronze floating bearings. Like the camshaft, the supercharger is driven from the reduction gear by the long, flexible shaft, which obviates the need for the clutches usually provided to take care of rapid changes in crankshaft speed.

A single Bendix Stromberg, four-barrel, downdraft carburetor with automatic mixture control is mounted on the rear of the accessory housing, and supplies fuel-air mixture to the supercharger, which in turn delivers it to ramming-type manifolds that are provided with grids designed to prevent back-fire flames from reaching the supercharger.

Ignition is by a high-tension Scintilla double magneto with fixed timing. Sparks are distributed to the various plugs through two separate distributors driven from the camshaft. There are two spark plugs in each cylinder. When the engine is enclosed in a tight cowl, a blast of cooling air is blown over the exhaust-side plugs through an aluminum manifold.

With this high-temperature-liquid-cooled engine the installation of a turbo charger is said to offer particular advantages. It can be mounted directly below the engine, or to either side of the latter, with a short exhaust line and short air-pressure lines to the inter-coolers and the carburetor. The cooling system also permits of locating radiator equipment in places on the plane where it occasions the minimum drag. In fact, the chief advantage of a liquid-cooled engine using a high-boiling-point coolant appears to be that it cuts down the air drag. Such reduction in the drag makes possible the attainment of higher speeds, and it seems that this type of engine offers special advantages for military work and possibly for long-distance commercial flying at high speeds and high altitudes, for which service it would be fitted with a turbo-type of supercharger.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